METAL FINISHING

PREPARATION, ELECTROPLATING, COATING

PUBLISHED FOR THIRTY-SEVEN YEARS AS METAL INDUSTRY

Aug 30

1533

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COPY

AD-LEA-SIVE IN BAR FORM*

Broadens the Use of LEA Compound for Burring, Polishing and Buffing

Makes the LEA Method of Finishing More Versatile

AD-LEA-SIVE is a special glue base sizing now available in bar form, making it easy and economical to apply to the wheel for forming a strongly adhering base for LEA Compound. Because several setting up operations can now be eliminated . . . because wheel life and production can be increased . . . because wheel inventories can be reduced . . . costs can be reduced!

By virtue of this stronger base, LEA Compound, an excellent and already widely used cutting and polishing composition can be applied to articles hitherto not suitable. Many more articles can now enjoy the economy and better finishing of the LEA Method.

Write for free sample bar of AD-LEA-SIVE and try it in your own operations. Directions for use are on the label.

*Patents Pending

THE LEA MANUFACTURING CO.

Waterbury 86 Connecticut

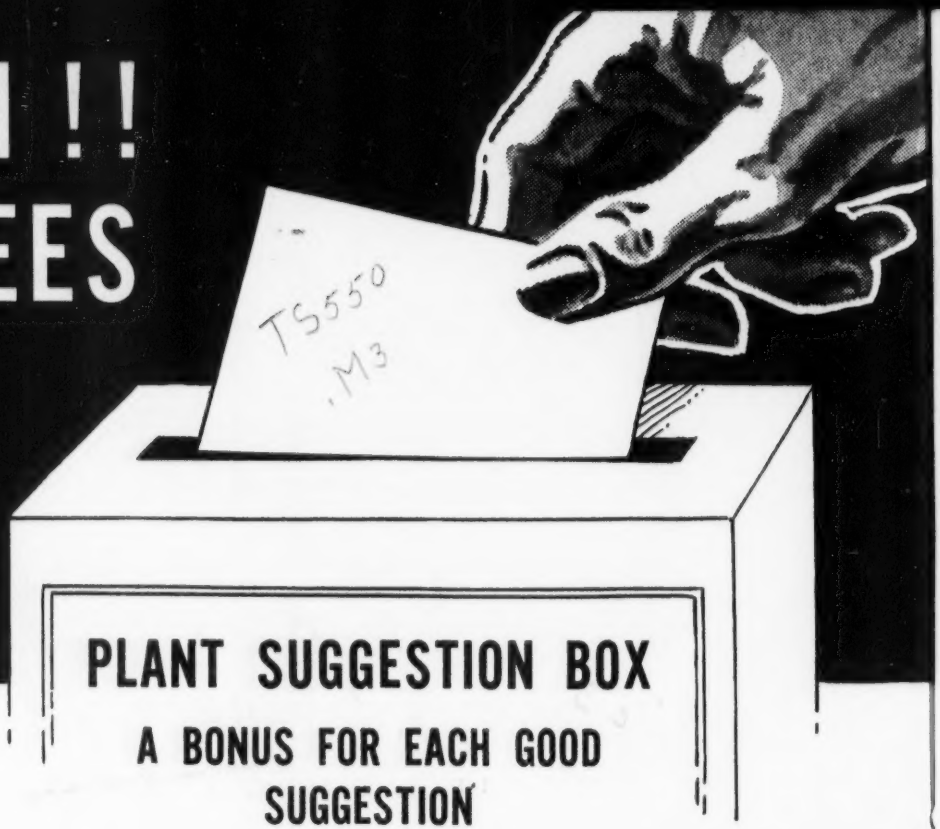
Burring, Buffing and Polishing . . . Specialists in the Development of Production Methods and Compositions

7-LM-1

r, 1943—41st YEAR

ATTENTION !! EMPLOYEES

HAVE YOU A SUGGESTION BOX IN YOUR PLANT?



. . . HERE'S A CHANCE TO *Win A Bonus* FROM YOUR FIRM BY SUBMITTING THIS IDEA!

Most all War Production plants encourage employees to use plant suggestion boxes. Bonuses are paid for successful suggestions which save man-hours and cut production costs.

We would recommend that you make an inspection of the deburring methods used in your plant. If hand filing, belt grinding or hard wheeling is being used, suggest the substitution of barrel deburring with the Clepolon Process. In the suggestion, you might mention that sample parts can be sent to our laboratory for deburring. These would be returned for inspection with complete operating recommendations.

The Clepolon Process has saved over ten-million hours of labor in the last two years. Your plant can also save many man-hours of deburring labor with the Clepolon Process.

Buy War Bonds and Stamps

FREDERICK **GUMM** *Chemical Company*

538 FOREST STREET, KEARNY, N. J.

JUL 26 1943

EBONOL "C" the BLACKENING PROCESS for Copper and Copper Alloys

EBONOL "C" is unique! It produces hard, adherent, black inorganic finishes (either dull or glossy) on Copper, Brass or Bronze.

It is not a sulphide type black but a cupric oxide finish, with all the physical and chemical advantages of cupric oxide. The coatings are far superior to black nickel, and require no critical materials. The finishes are easy to apply to either large single objects or small parts in bulk. Simple immersion for from 2 to 15 minutes at 200°F is all that is necessary. Control is also simple.

EBONOL "C" finishes are widely used and approved for the blackening of war goods such as optical items, measuring and precision instruments, grommets, wire products and airplane accessories.

Other metals can also be given the superior EBONOL "C" BLACK FINISH by first copper plating.

Other EBONOL Blackening Processes

EBONOL "A" for Aluminum and its alloys
EBONOL "S" for Iron and Steel
EBONOL "Z" for Zinc plate and Zinc alloys

Write for Folder "C" or send samples for processing.

THE Enthone CO.
NEW HAVEN, CONN.

Chicago Representative:
GEORGE A. STUTZ MFG. CO.
1641 Carroll Ave., Chicago

Detroit Representative:
FREDERIC B. STEVENS, Inc.
Larned & 3rd Sts., Detroit

DEGREASE & CLEAN ALL YOUR WAR PRODUCTS

the **FAST** *performance-proved* **OAKITE WAY!**

FOR DEGREASING aluminum, brass, copper, magnesium, zinc and steel parts before inspection and assembly . . . or before electroplating, painting, black oxide finishing or other protective surface treatment operations . . . thousands of plants working on war orders are using specialized Oakite cleaning materials because they EFFECTIVELY meet the demand for FASTER cleaning cycles to SPEED production.

These SAFE, performance-proved materials, used in tanks and automatic washing machines, provide UNIFORM, TROUBLE-FREE results in removing oil, grease. smut, polishing and buffing compounds . . . and do this on a consistently THOROUGH, FAST basis, hour after hour, day after day, to help keep production lines moving ahead of schedule! Moreover, since Oakite degreasing provides CHEMICALLY CLEAN surfaces, it is an indispensable aid in securing QUALITY finishes.

Put Your Degreasing Problems Up To Us!

To any plant engaged in war work, Oakite Engineering and Advisory Service is available without obligation on any cleaning operation that must be performed FASTER, EASIER. Whether or not you are now using Oakite materials, ALL our facilities . . . our 34 years' successful experience and specialized knowledge, our Nation-Wide Field Service Staff, our Research Laboratories . . . are at your command to help you fulfill the specifications and delivery requirements called for by your contract. Inquiries answered promptly . . . write TODAY!

Manufactured only by

OAKITE PRODUCTS, INC., 18 Thames Street, NEW YORK, N. Y.

Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE WARTIME SERVICE

FREE

TO PLANTS MAKING

AIRPLANES . . . MOTORS
PROPELLERS . . . INSTRUMENTS
CARTRIDGES . . . SHELLS
FUSE BODIES . . . DETONATOR CAPS
BOMB CASES . . . AMMUNITION BOXES
CARTRIDGE AND SHELL CASES
MACHINE GUNS . . . CANNONS
GUN MOUNTS . . . GUN CARRIERS
TORPEDO PARTS
RECOIL MECHANISMS
BREECH RINGS . . . BREECH BLOCKS
RIFLES . . . PISTOLS . . . REVOLVERS
TANKS . . . TRACTORS . . . TRUCKS
MOTORCYCLES . . . MOTOR SCOOTS
TRENCH MORTARS . . . HOWITZERS
SCOUT CARS . . . ARMORED CARS
GAS MASKS . . . HELMETS
COMMUNICATION EQUIPMENT
FIRE-CONTROL INSTRUMENTS
SEARCHLIGHTS . . . RANGE FINDERS

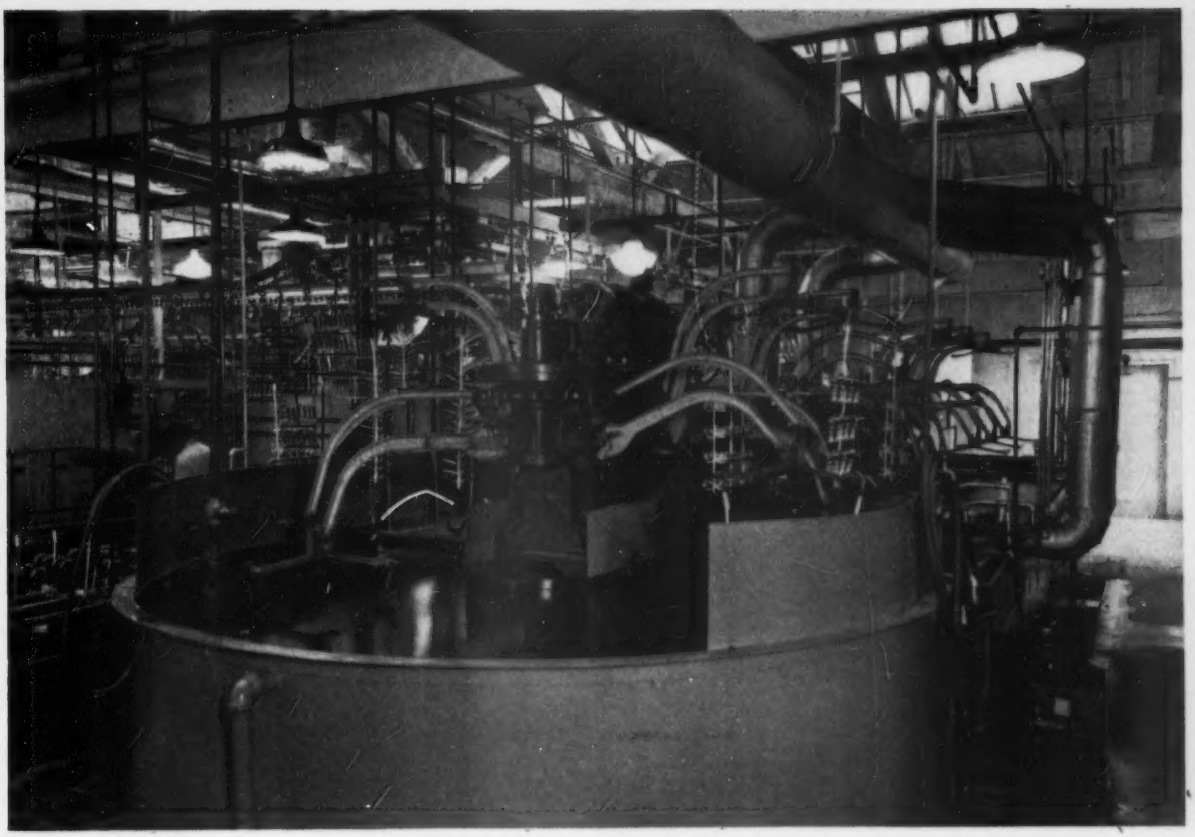
OAKITE MATERIALS . . . METHODS . . . SERVICE

CLEANING FOR EVERY CLEANING REQUIREMENT

METAL FINISHING is Published monthly by The Metal Industry Publishing Company, 11 West 42nd Street, New York, N. Y., U. S. A. Entered as second class matter February 25, 1903, at the Post Office in New York under the Act of March 3, 1879. Volume 41, Number 7, July, 1943. Two Dollars Per Year.

STEVENS

• FOR ANY PROCESS



• FOR ANY PRODUCT

AUTOMATIC and SEMI-AUTOMATIC PLATING EQUIPMENT

★ Even before Pearl Harbor, many plants were quickly and inexpensively converting their Stevens Equipment from peace-time finishing to anodizing, magnesium treatment, or other war-time finishing requirements.

★ If and when your program calls for the reconversion of your present equipment, or, if you contemplate the addition of new equipment to meet post-war conditions, we will be glad to discuss your plans with you—study your operations, and make our suggestions and recommendations.

★ *Right now there's a war to be won, and, if we can be of assistance to you in speeding the day of complete victory, please feel free to call upon us at any time.*

★

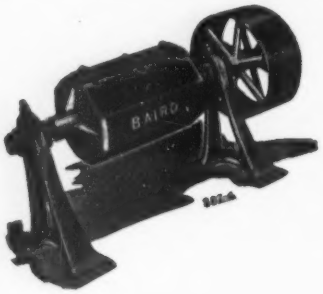
FREDERIC B. Stevens INCORPORATED

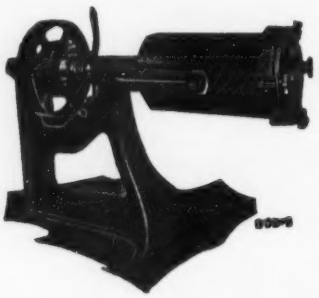
DETROIT • MICHIGAN

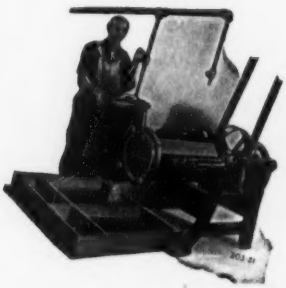
• BUFFALO
• INDIANAPOLIS
• NEW HAVEN

CLEVELAND
WINDSOR
TORONTO

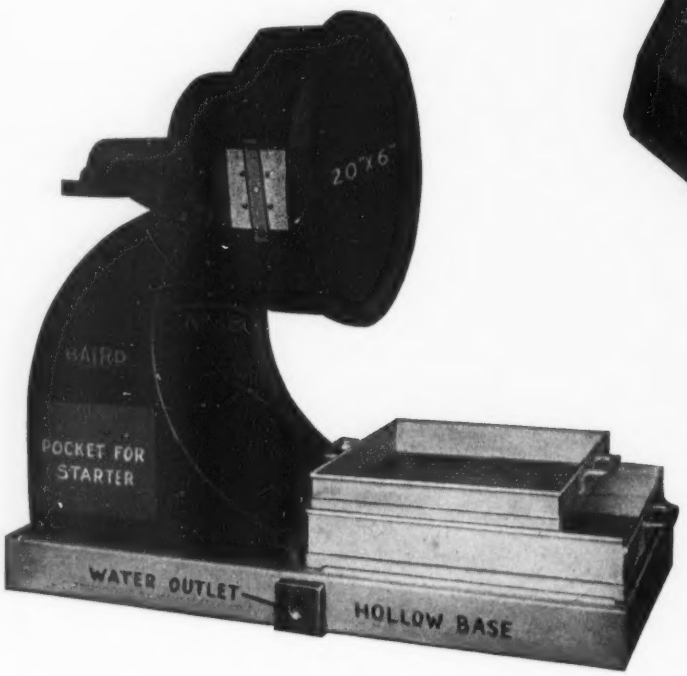
"Everything for Polishing and Plating"

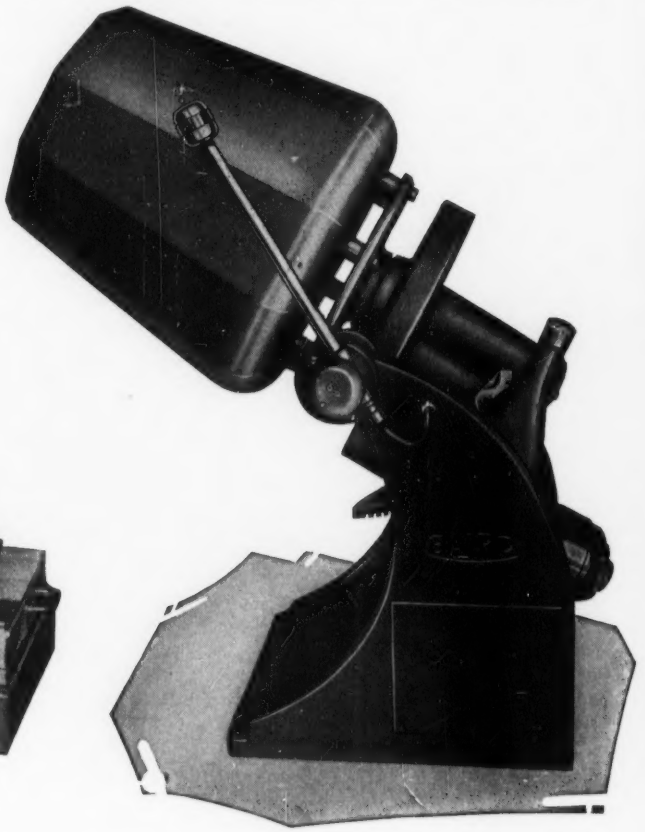






HORIZONTAL BARRELS **TILTING BALL BURNISHING BARRELS**





This shows a High and Narrow Type of Barrel mounted on "Baird" Model D. or Pedestal Type Motor driven Oblique Tilting Tumbler.

As shown the barrel was lined for use for burnishing with hardened steel balls.

These barrels may be of any suitable material depending on the job. Cast iron or fabricated steel unlined or lined with rubber etc. for rolling in abrasives.

Made in 20" dia. x 6" for No. 1 Tumbler
Made in 24" dia. x 8" for No. 2 Tumbler

This shows the side of a No. 1 BAIRD Model D. Single Oblique Tilting Tumbler with a No. 22 Sheet Steel Polygonal Barrel and with an Automatic Electrical Tilting Device.

This device AFFORDS GREATEST SAFETY — LEAST LABOR — LEAST FLOOR SPACE—LEAST AMOUNT OF DISTANCE TO MOVE WORK in USING the tumbling barrels. SAVES TIME AND FLOOR SPACE.

When tumbling questions come up "ASK BAIRD ABOUT IT"

AUTOMATIC MACHINERY BAIRD STRATFORD CONNECTICUT, U.S.A.

THE BAIRD MACHINE COMPANY

STRATFORD, CONNECTICUT

Since 1846 specializing in high production machinery for articles of wire and for ribbon metal. Also machines to turn, bore, etc., castings, forgings, etc., up to 10½" diameter.

STEEL SHELL CASES SAVE BRASS...

in revolutionary new process

PENNSALT CLEANERS

Reg. U. S. Pat. Off.

help large manufacturer in change-over

The substitution of steel for brass in cartridge and shell cases has necessitated new metalworking methods and new metal cleaning operations as well.

One of the country's leading motor car makers recently made this change-over in the mass production of 75 millimeter shell cases. A Pennsalt cleaner is used in many of the important metal cleaning operations, and it has been found particularly efficient in cleaning the cases prior to Bonderizing.

Pennsalt Cleaners are proving highly satisfactory for this special work in many plants for this very good reason: Penn Salt men have had practical experience developing and applying cleaners for billions of rounds of ammunition cases.

The experience of our trained servicemen can be brought to bear on *your* metal cleaning problem, without obligation. For complete information write our Pennsalt Cleaner Division, Dept. MF.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • MINNEAPOLIS • WYANDOTTE • TACOMA

EVERY POUND MADE WITH "END USE" IN MIND!

Making basic materials for fabrication *by others* carries with it a heavy responsibility. To succeed in this requires measuring up to the ideals of that bracket of manufacturers who are known for their exacting standards of production—who demand uniformity of quality down to the tiniest spring! So, peace or war, this is the mark "Seymour" must shoot at *and hit*—and, incidentally, it is the reason for the high state of development of these principal Seymour Products:

SEYMOUR NICKEL SILVER is an alloy of copper, nickel and zinc. Fine grain, good corrosion resistance and a silvery white color make it an ideal base for silver, nickel and chromium plating. Takes any hardness from dead soft to spring temper. Excellent for deep draws and difficult spinning. Leaded, it machines freely.

SEYMOUR PHOSPHOR BRONZE is an alloy of copper, tin and phosphorus. Highly resistant to corrosion, abrasion, friction and fatigue. Springs made of it stand almost indefinite flexure. Practically indifferent to thermal change in most applications. In all ranges of hardness and leaded for machining.

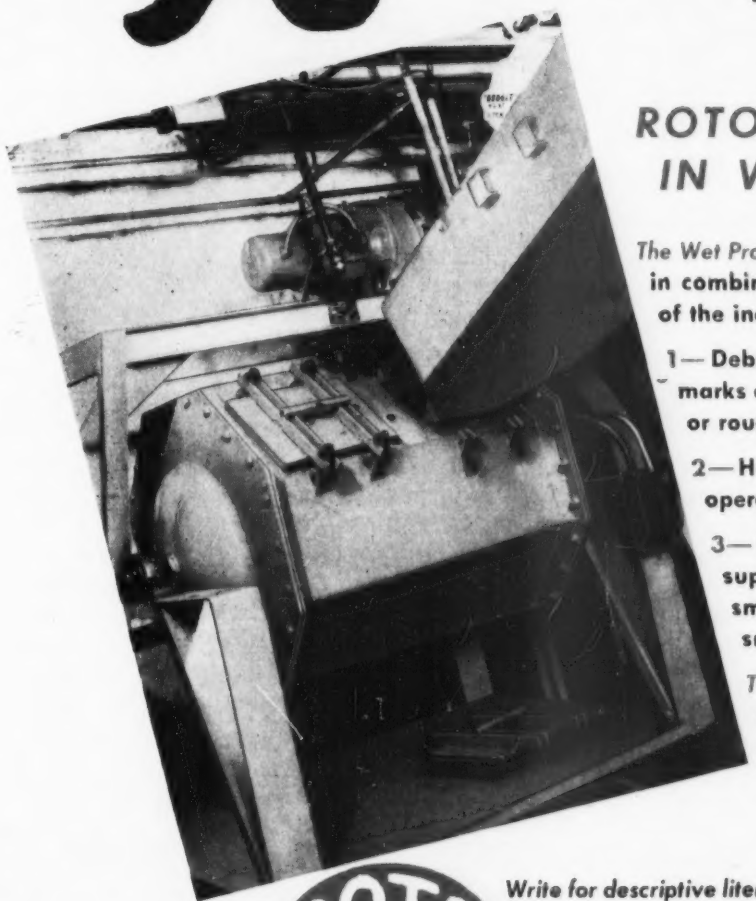
SEYMOUR NICKEL ANODES are made of virgin nickel, melted in the electric furnace under pyrometric control and laboratory check. Outstanding is the "Seycast" 99%+ cast nickel anode with radial "anchored" grains that tend to eliminate loose nickel in low pH baths. Designed primarily for Bright Nickel, but will give excellent results in any hot Watts bath having a pH of 4.5 (electrometric) or lower.

THE SEYMOUR MANUFACTURING CO.
70 FRANKLIN ST., SEYMOUR, CONN.

SEYMOUR

...when you put them in a Roto-Finish BARREL...

you're actually saving TIME and MONEY



ROTO-FINISH IS AVAILABLE IN WET OR DRY PROCESS

The Wet Process combines three separate operations—used in combination or separately, according to requirements of the individual job.

1—Deburring or grinding eliminates spinning, draw marks or "orange peel." It also smoothes sharp corners or rough edges before assembling.

2—Honing produces a much finer job than grinding operations, and gives the work a bright finish.

3—Coloring is a fine finishing operation, often superior to the best hand-finished job—producing a smooth, bright finish. Especially adaptable for small, irregularly shaped parts.

The Dry Process effectively smoothes the surface and edges of the parts through an abrasive action. It turns the parts out clean and dry—being well suited for handling brass castings, light gauge steel, and brass stampings and die cast stampings before plating.

Write for descriptive literature and name of our nearest distributor.

ROTO FINISH
STURGIS PRODUCTS CO.
Sole Owners

STURGIS PRODUCTS CO.
STURGIS • MICHIGAN

DARCO Bars "Enemy Aliens" from Plating Surfaces

With Darco on guard in your solution, grease, oil, soaps, colloidal impurities and decomposition products can't reach plating surfaces. Darco carbon halts these saboteurs!

Continuous filtration with Darco S-51 catches and *adsorbs* even the unseen, unnoticed traces of impurities that can ruin plating. Periodic filtration may let some of them slip by between treatments.

Many of the country's important plants have proved that 24-hour protection with Darco pays dividends. Even with today's heavy schedules, Darco's continuous filtration gives complete satisfaction. Continuous purification permits much smaller dosages, because impurities are not allowed to build up. Ten cents buys enough to keep 100 gallons of solution clean for a week.

Be sure to specify Darco in the trademarked package.

The article, "Physical Removal of Impurities from Plating Solutions," discusses continuous filtration in detail. Write for a copy.

Current pressure to get work done means overloading the cleaning cycle, causing excessive greases, oils, etc., to be dragged over into the plating tanks. Darco helps meet this situation.

DARCO—Reg. U. S. Pat. Off.

DARCO

This trade-mark identifies the genuine. Accept no packages without it.

DARCO

CORPORATION

60 East 42nd Street, New York, N. Y.

Remove Copper with McKEON'S

"Liquid Sulphur"

TRADE MARK REG'D

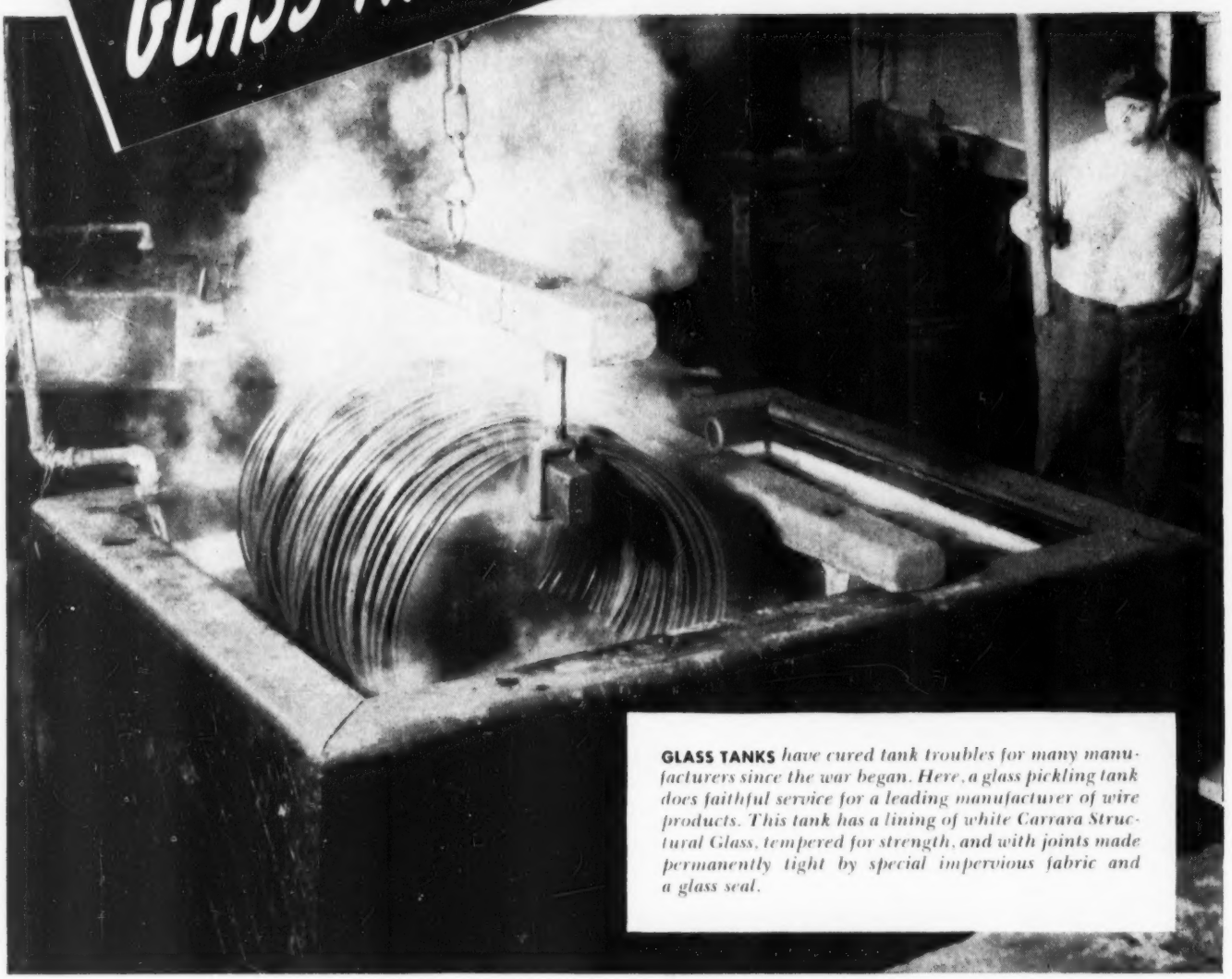
ASK

SULPHUR PRODUCTS CO.

Greensburg, Pa.

The facts about a new sensation . . .

GLASS TANKS by "Pittsburgh"



GLASS TANKS *have cured tank troubles for many manufacturers since the war began. Here, a glass pickling tank does faithful service for a leading manufacturer of wire products. This tank has a lining of white Carrara Structural Glass, tempered for strength, and with joints made permanently tight by special impervious fabric and a glass seal.*

• It's easy to see why so many users are enthusiastic about glass tanks by "Pittsburgh". These glass tanks offer a unique combination of advantages, whether you use them for pickling metal or storing tomato juice.

Being glass, they are impervious to acids, alkalis, chemicals, liquids of practically every kind. They are made with specially tempered glass which is exceptionally strong and resistant to thermal shock. The glass, of course, will not rot, will not contaminate any chemical with which it comes in contact. It is non-porous and non-absorptive. As a consequence, glass tanks are very durable and long-lasting in service.

Pittsburgh Plate Glass Company makes these tanks in a variety of types and sizes. With inside facing of glass and outer shell of wood, or with glass facing both inside and out. And if you desire, crews of "Pittsburgh" workmen will come into your plant and *line* your present tanks with glass, whatever their size.

Glass tanks are *better* tanks. Yet they can be furnished promptly, since glass is not subject to the priority restrictions now placed on many other tank materials.

Write us . . . today . . . explaining your requirements. We will gladly work with you on the application of these remarkable new glass tanks to your specific needs. Pittsburgh Plate Glass Company, 2060-3 Grant Building, Pittsburgh, Pennsylvania.

PITTSBURGH PLATE GLASS COMPANY

"PITTSBURGH" stands for Quality Glass and Paint

What's New From DuPont?

SULFAMATE LEAD PLATING

Faster, Safer Method Provides Smooth Dense Deposits at 100% Current Efficiency

The sulfamate solution is less corrosive and safer to operate than the old type. It is easily made up and maintained with prepared sulfamate lead salts, and controlled in the usual way. Its simplicity, long life and stability bring economical operation to still or barrel plating.

The process is carried out in the usual rubber- or Neoprene-lined steel plating equipment. Simple addition agents are added as required. Smooth, dense, relatively pore-free coatings from 0.00005″ to 0.0025″ in thickness are readily obtained. Though not especially suited to decorative requirements, the lead deposit furnishes high corrosion-resistance to parts intended for use under many severely corrosive conditions.

Technical information and assistance in the specific application of the process can be obtained from our nearest district office. Electroplating Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington, Delaware.

DU PONT
REG. U. S. PAT. OFF.

ELECTROPLATING

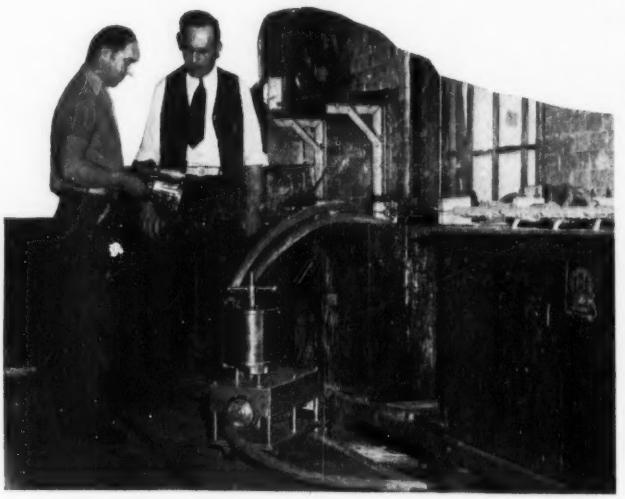
CHEMICALS • PROCESSES • SERVICE

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

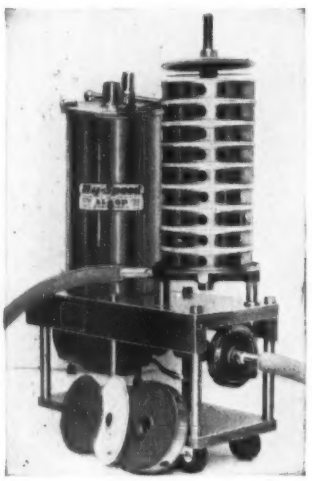
Alsop

"SEALED DISC" FILTERS

(for plating solutions)



"Clean Plating Solutions by Filtration?"



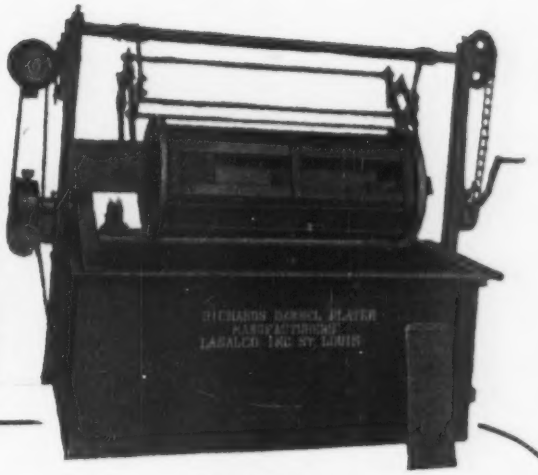
"Right, Jim, but not just filtration—'Sealed Disc' filtration. There's a big difference. See these two pieces, the one in my right hand is a beautiful finish the result after our solution was completely cleaned of all the dirt, sediment and impurities generally present in the materials we use in making our solutions. Before 'Sealed Disc' filtration the result was as in the piece in my left hand. The foreign impurities in the tank may mean spotty finish, that means refinishing, time lost and production slowed down. With this small, compact filter we increase production and get finer finishes. Fewer rejects."

Portable types to move from tank to tank.

Send for our filter book.

ALSOP ENGINEERING CORP.
27 Bright Street **Milldale, Conn.**

Give Your Plating and Finishing Room Problems to a LASALCO ENGINEER



Barrel Plater

Burnishing Barrel

Here is a list of some of the equipment and supplies he has available to give you the *right* solution quickly.

Plating Barrels:
- Utility
- Bull's Eye
- Richards

Burnishing Barrels
Tumbling Barrels
Cushioned Belt Grinders
Electric Sawdust Tumblers
Full Automatic Machines
Semi-Automatic Machines
Hard Chrome Equipment
Anodizing Equipment
Magnesium Treating Equipment
Descaling Equipment
Blackening Process

Special Plating Machines to meet any requirement
Buffs and Polishing Wheels
Tripoli
White Finish
Chrome Composition
Emery Cake
Grease Stick
Stainless Steel Composition
Crocus
Anodes:

Nickel	Cadmium
Copper	Lead
Brass	Gold
Zinc	Silver

Cushioned Belt Grinder

Complete Line of Chemicals and Supplies for Plating

- Nickel Salts
- Chromic Acid
- Sodium Cyanide
- Copper Cyanide
- Zinc Cyanide, etc.

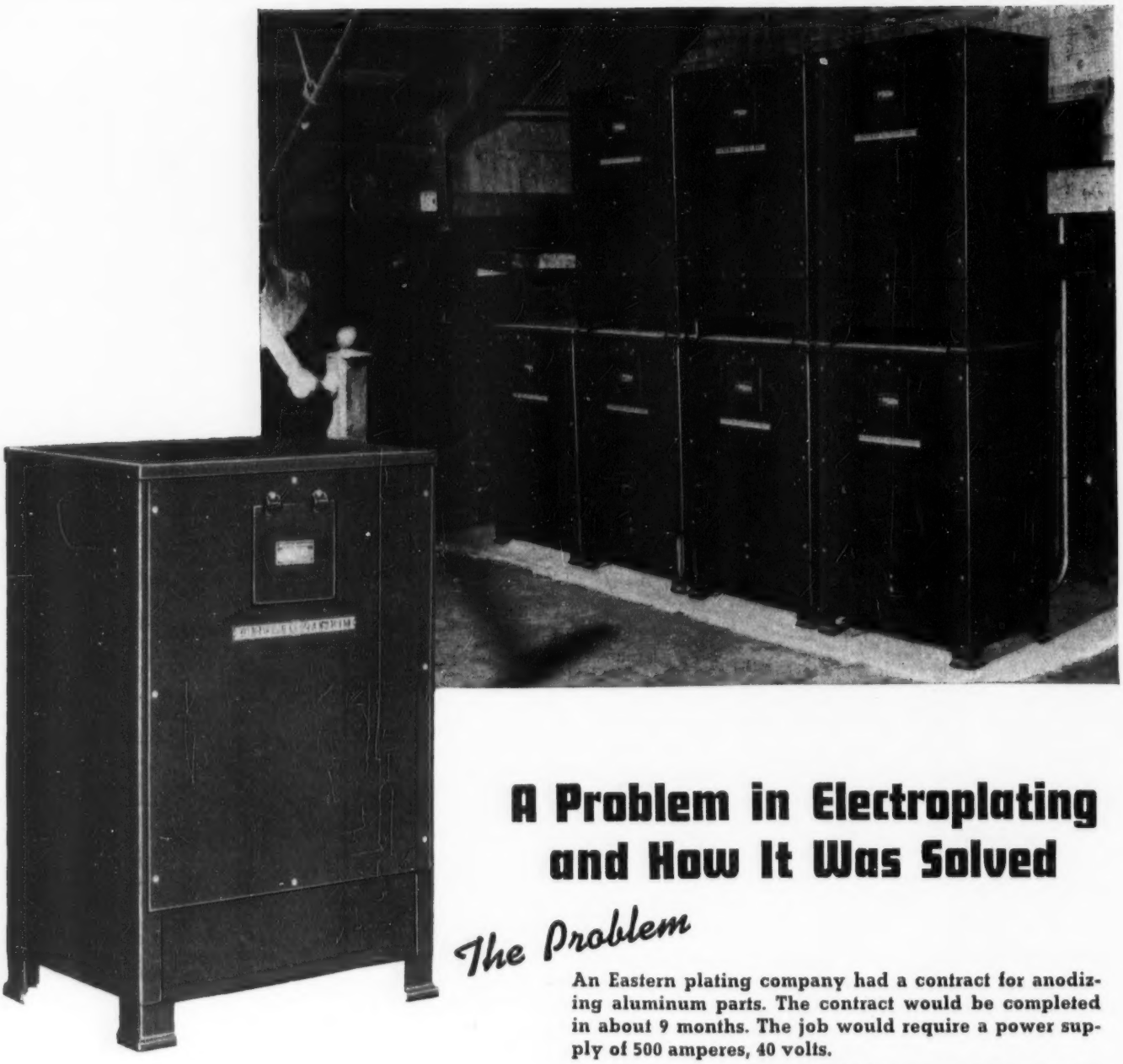
GE Copper Oxide Rectifiers
Sangamo Amperehour Meters
Cadalyte Cadmium Solution
Zin-O-Lyte Zinc Solution
DuPont Hi-Speed Copper
Chandeysson Generators
Lea Products

MacDermid Cleaners
Dipping Baskets
Scratch Brushes
Scrub Brushes
Sawdust
Maizo Meal
Copper Wire
Insulating Steam Joints
Rheostats
Test Sets
Plating Racks
Stop-Off Lacquers
Rack Lacquers

Write today for complete information —or ask a Lasalco Engineer to call.

LASALCO, INC.

2818-38 LaSalle St., St. Louis, Mo.



A Problem in Electroplating and How It Was Solved

The Problem

An Eastern plating company had a contract for anodizing aluminum parts. The contract would be completed in about 9 months. The job would require a power supply of 500 amperes, 40 volts.

When, if ever, there would be another job requiring 40-volt equipment was uncertain. Most likely the next job would be low-voltage plating requiring 6 volts. The problem was: What equipment would serve both these widely different requirements.

The Solution

Here's how the needed flexibility was obtained: Seven standard 500 ampere, 6-volt G-E Copper Oxide Rectifiers were purchased. By a series connection and regulator control, this equipment was adapted to operate over a range from 1 to 40 volts at 500 amperes. When the contract was completed, the same equipment was relocated at two different points in such a way that 4 units were used for a plating job requiring 12 volts, 1000 amperes, while the other 3 units were set up on a job requiring 6 volts, 1500 amperes.

This illustrates only one of the many electroplating power supply problems that can be solved through flexible G-E Copper Oxide Rectifiers. Whatever your problem, General Electric Metallic Rectifier Engineers will be glad to consult with you. For additional information, write to Section A732-75 Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

HIGH-SPEED PRODUCTION + CLEANING

This is a war of men against metal. Of machine against machine, and of metal against metal.

Metal cleaning is an important part of all present-day manufacture—whether it is machine guns, airplane parts, cartridge cases (brass and steel), A. P. and H. E. shot, or ammunition boxes. Ammunition and equipment cannot be put into service faster than the component parts can be cleaned.

In these swift-moving times Wyandotte Field Engineers are on call twenty-four hours a day. They are constantly in the field—working with those in charge of metal degreasing in the arsenals and the production shops of the nation.

If you have a problem in metal cleaning, the chances are that a Wyandotte man has met that problem or its twin brother, in the course of his daily work. He will be glad to work with you to obtain improved results, increased speed, or lower costs. *Many times Wyandotte has solved all three problems at once.*

We are ready to help you NOW!

SERVICE REPRESENTATIVES IN 88 CITIES

WYANDOTTE CHEMICALS CORPORATION

J. B. FORD DIVISION • WYANDOTTE, MICHIGAN

• *Wyandotte Chemicals Corporation consolidates the resources and facilities of Michigan Alkali Company and The J. B. Ford Company to better serve the nation's war and post-war needs.*

DU-LITE

Can Take It, Too!

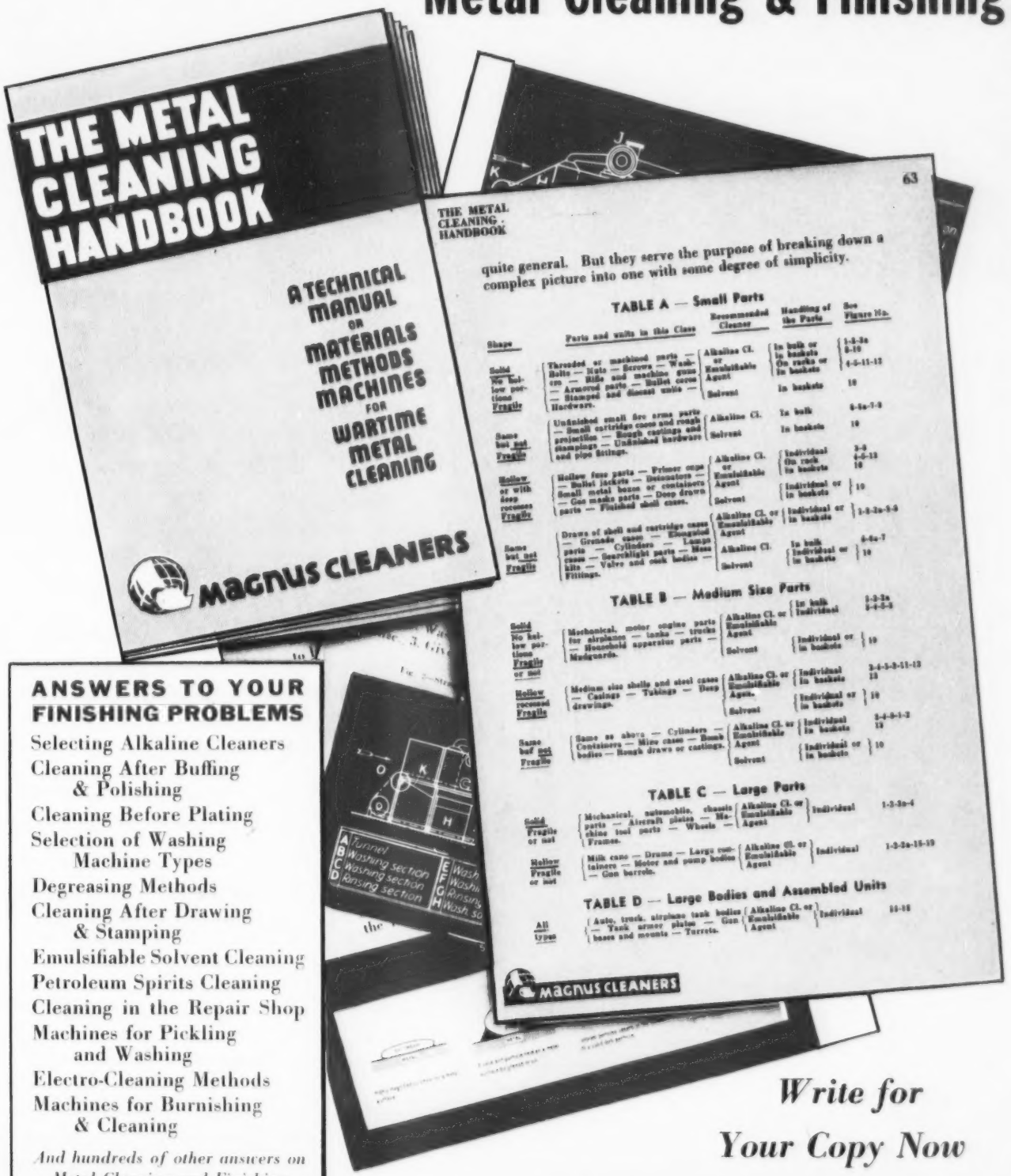
Du-Lite black oxide finish is a tough, protective, rust resistant finish for most parts of steel and steel alloys. It will stand up under exacting conditions of weather and abuse. Du-Lite, too, can take it.

Du-Lite meets the requirements and specifications of war production, and is being successfully used on steel parts of tank, marine, automotive, and airplane engines; arms and guns; cartridge clips; bomb parts; tools and many other items.

Du-Lite Engineers are scattered throughout the industrial reaches of the United States, within easy access to your plant. They are trained men, qualified to consult with you about your steel finishing problems. Wire Middletown and we'll have the Du-Lite man in your office within a few hours.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONNECTICUT

The Only COMPLETE Manual on Metal Cleaning & Finishing


THE METAL CLEANING HANDBOOK
A TECHNICAL MANUAL ON MATERIALS METHODS MACHINES FOR WARTIME METAL CLEANING
Magnus CLEANERS
THE METAL CLEANING HANDBOOK
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quite general. But they serve the purpose of breaking down a complex picture into one with some degree of simplicity.
TABLE A — Small Parts
TABLE B — Medium Size Parts
TABLE C — Large Parts
TABLE D — Large Bodies and Assembled Units
Magnus CLEANERS

ANSWERS TO YOUR FINISHING PROBLEMS

Selecting Alkaline Cleaners
Cleaning After Buffing & Polishing
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Cleaning After Drawing & Stamping
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And hundreds of other answers on Metal Cleaning and Finishing Operations

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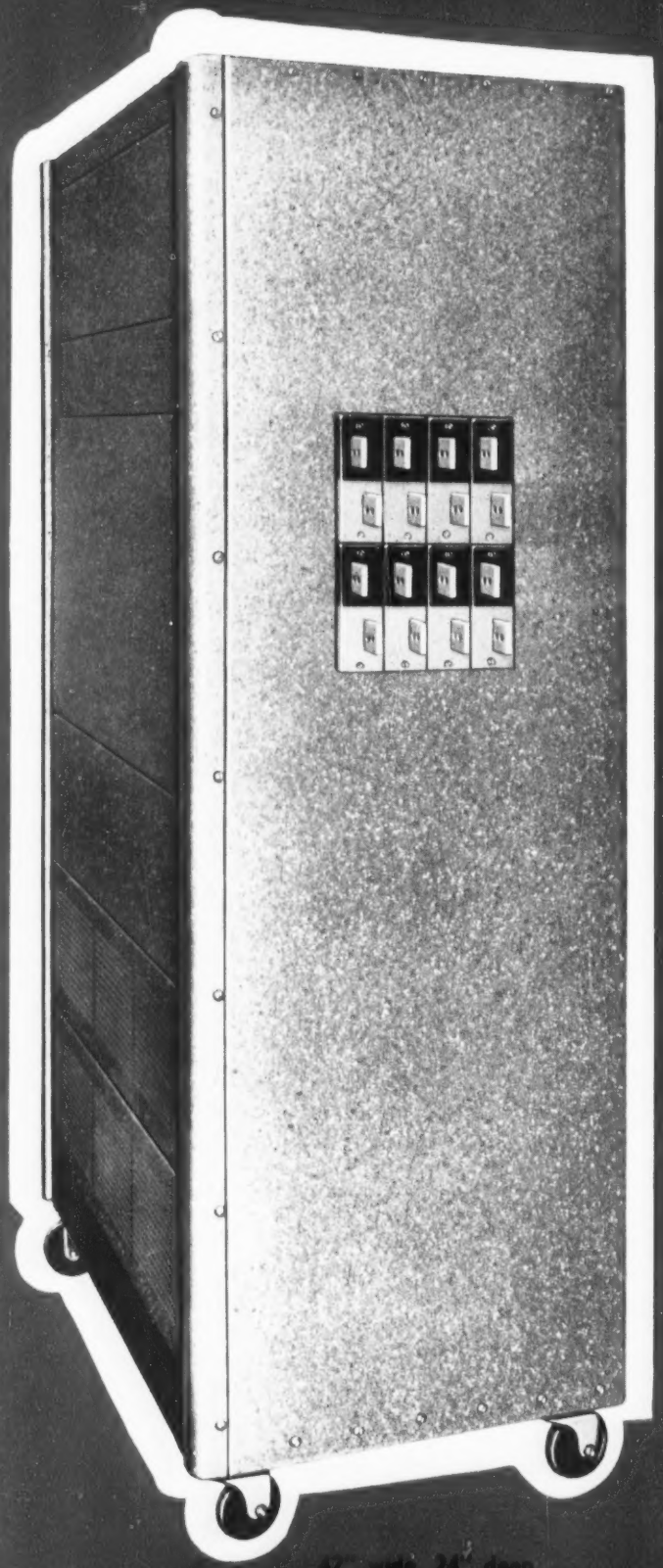
MAGNUS CHEMICAL CO.
11 SOUTH AVENUE GARWOOD, N. J.

Magnus CLEANERS-METHODS-MACHINES

GREEN MULTI-PLATER



42" wide, 24" deep
approx. 81" high.

The MULTI-PLATER provides, in **one** cabinet, **eight** (8) separate selenium rectifier sections **each** having an output capacity of **6 volts 500 amperes.**

For quick, simple installation and mobility, MULTI-PLATERS are mounted on cone bearing casters.

Separate output terminals make it possible to connect each rectifier section to a separate tank, or several sections may be added together for higher voltage or greater current capacity, or **all** the sections may be grouped together in a single bank.

When sections are used individually, or in groups, there are **several hundred** possible combinations; for example: If all eight sections are interconnected any one of the following outputs may be obtained:

6 volts 4000 amperes,
or 12 volts 2000 amperes,
or 24 volts 1000 amperes,
or 48 volts 500 amperes.

Standard MULTI-PLATERS provide internal connections for operation from 220, 260, or 440 volt 60 cycle 3 phase supply.

MULTI-PLATERS can be furnished for other supply voltages.

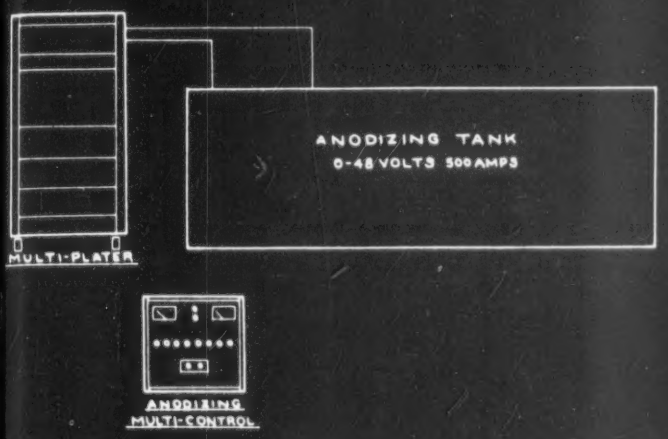
MULTI-PLATERS of lesser capacity than model 86, as illustrated, are also available.

W. GREEN ELECTRIC CO., INC.

RECTIFIER ENGINEERS
NEW YORK, N. Y.

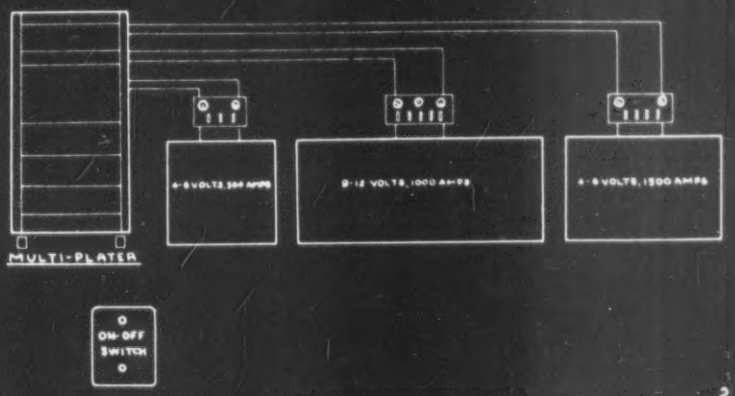
A FEW MULTI-PLATER LAYOUTS

CHROMIC ACID ANODIZING



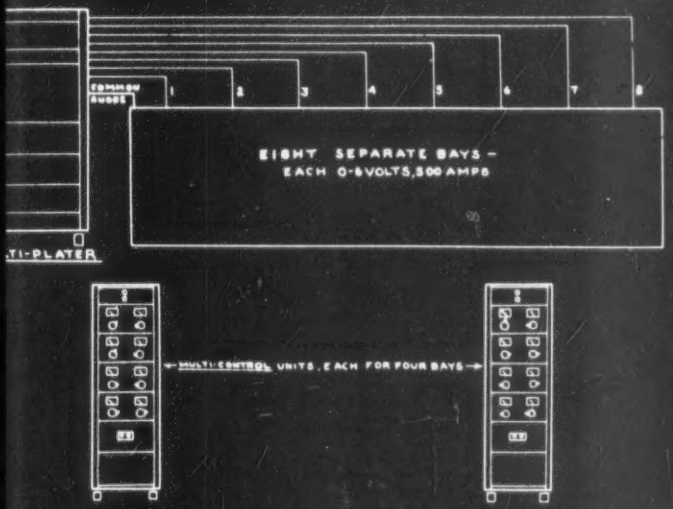
1

TANK PLATING
(USING OLD INSTALLATION WITH EXISTING RHEOSTATS)



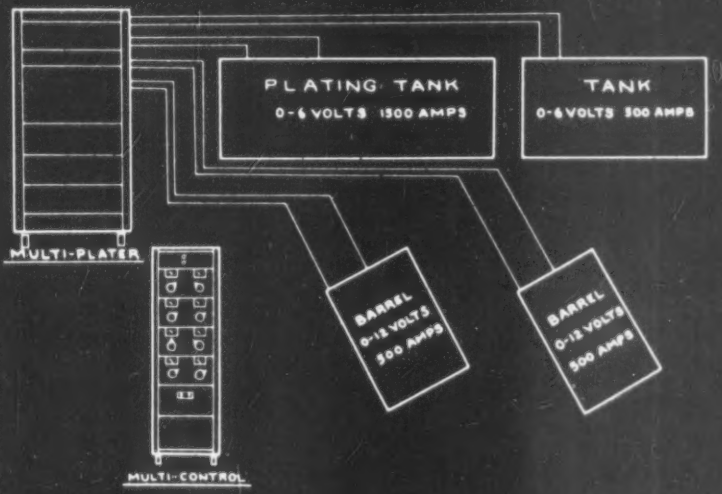
2

LATING - EIGHT BAYS IN ONE TANK



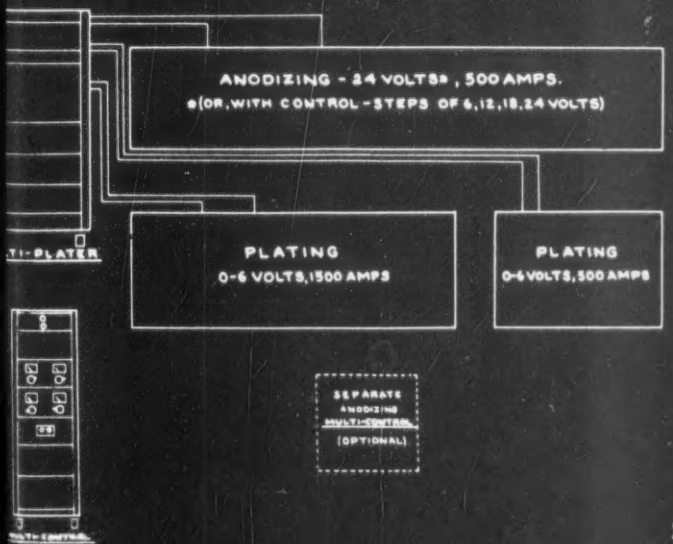
3

TANK & BARREL PLATING



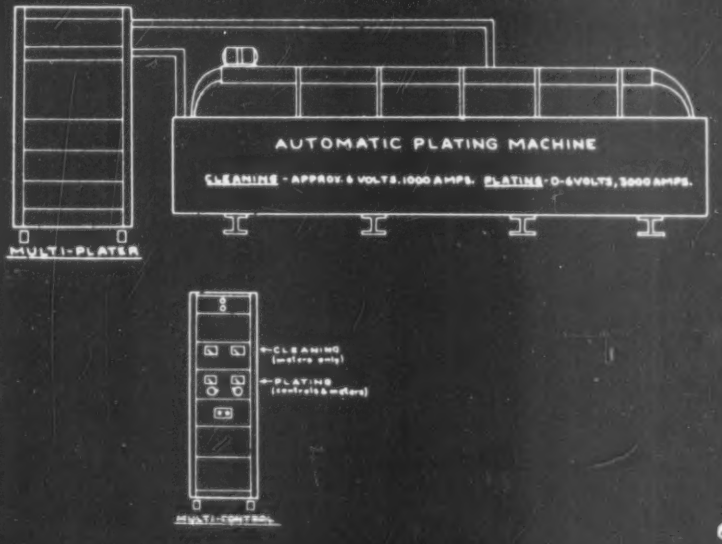
4

SULPHURIC ANODIZING & PLATING


ANODIZING - 24 VOLTS*, 500 AMPS.
*(OR, WITH CONTROL - STEPS OF 6, 12, 18, 24 VOLTS)
PLATING
0-6 VOLTS, 1500 AMPS
PLATING
0-6 VOLTS, 500 AMPS
SEPARATE ANODIZING MULTI-CONTROL (OPTIONAL)

5

PLATING - AUTOMATIC MACHINE


AUTOMATIC PLATING MACHINE
CLEANING - APPROX. 6 VOLTS, 1000 AMPS. PLATING - 0-6 VOLTS, 3000 AMPS.
MULTI-PLATER
CLEANING (motors only)
PLATING (controls & motors)
MULTI-CONTROL

6

ANODIZING LICENSES AVAILABLE *NOW*

TO JOB PLATERS AND MANUFACTURERS

To relieve present congestion in aluminum anodizing under Specification AN-QQA-696-a approved (Sulphuric Acid Type).

A few exclusive territorial licenses to job platers are still available.

TECHNICAL PROCESSES DIVISION
OF COLONIAL ALLOYS COMPANY
COLONIAL PHILADELPHIA BUILDING
PHILADELPHIA, PA.

To Produce That Better Finish
The Answer is

BRUSHING NUGLU

(THE GLUE AND ABRASIVES MIXED)

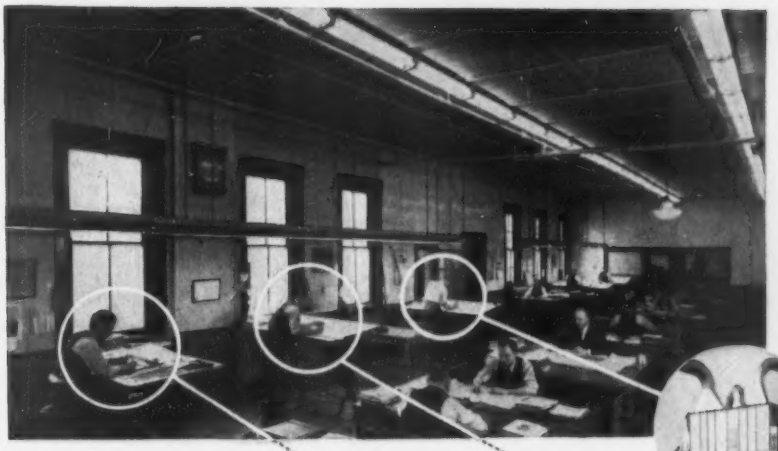
Dries immediately — Heat resistant

80% of the Aircraft Engine Mfrs. use it

Use it for coating and re-coating
Canvas and Abrasive

BELTS — DISCS — SLEEVES — FELT WHEELS AND BOBBINS

J. J. SIEFEN CO.
DETROIT



DUST and FUME CONTROL is a job for . . .

ENGINEERING SPECIALISTS

Dry products and clean air required; cloth filter selected.

Wet process air cleaning using Rotoclone.

Centrifugal separator suitable for heavy dust concentration.

An efficient dust or fume control system is a combination of various mechanical units, each of which is the *right* unit for the specific job to be done. Selection of the most efficient units for each kind and condition of dust and air is highly important—and highly difficult. It is decidedly a job for engineering specialists.

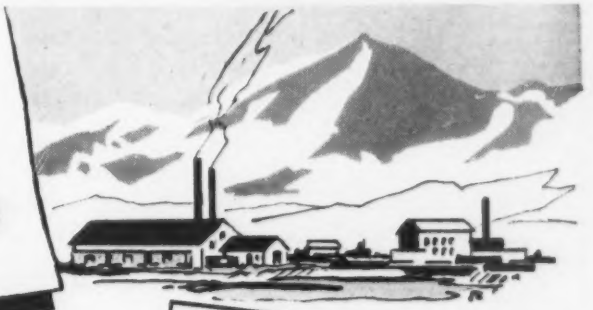
The Kirk & Blum Engineering Staff, qualified by over 36 years of experience in this particular field, first makes a thorough analysis of your special dust or fume control problem. Next, our Staff selects the right units for *your job* from among the various makes available—then designs and installs a complete system that is *guaranteed* by Kirk & Blum to give the results you want.

Don't take chances with a "half-way" dust or fume control system. Don't risk being "sold" on a unit or units that may not be right for your individual job. Get the unbiased counsel and planning of experts—Kirk & Blum Engineers.

For details write to The Kirk & Blum Manufacturing Co., 2859 Spring Grove Avenue, Cincinnati, Ohio.

KIRK AND BLUM
AN ORGANIZATION OF ENGINEERS AND MECHANICS

A PUMICE TO MEET EVERY NEED



Not until Valencia — the standard of American Pumice— was discovered at Grants, New Mexico, was it thought that a domestic pumice could match the quality of imported Italian Pumice. This inexhaustible deposit at Grants is true pumice stone and not a volcanic ash. It is physically and chemically equal in every respect to the now unobtainable Italian Pumice. • The Valencia plant's output of grades for every need is rigidly under control for particle size, purity, weight and color.

Check this table comparing Valencia with the highest grade of imported Italian Pumice. See for yourself that Valencia is truly the standard of American Pumice.

	American Pulverized Per Cent	Italian Select Per Cent
Silica	72.90	73.24
Alumina	11.28	10.61
Iron Oxide	.86	1.57
Titanium Oxide	.06	.10
Calcium Oxide	.80	1.10
Magnesium Oxide	.36	.40
Soda	3.64	3.03
Potash	4.38	5.58
Sulphuric Anhydride	.03	.05
Loss on ignition	5.20	4.04

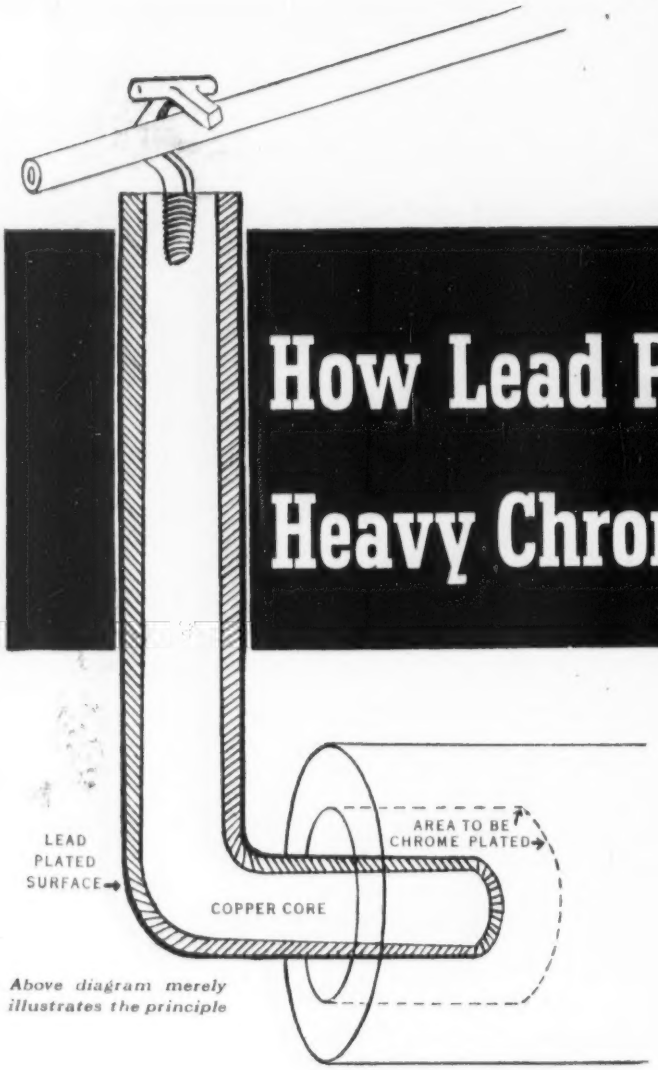
Distributors of
THE PUMICE CORPORATION of AMERICA
GRANTS NEW MEXICO

WHITTAKER, CLARK & DANIELS, INC.
260 WEST BROADWAY • NEW YORK CITY
Warehouses: Detroit, Michigan and South Kearny, N. J.

THIS IS A WAR-FACT AD

It is designed to give plain usable data in simplified form to save time.

How Lead Plating is Solving a Heavy Chrome Plating Problem



Above diagram merely illustrates the principle

Another important use for Harshaw Lead Fluoborate Solution

THE PROBLEM: When laying down a heavy deposit of chrome, a plater found it difficult to control current distribution, especially where hard-to-reach places had to be plated evenly. The relatively high resistance of solid lead anodes resulted in deposits being excessively thick on some areas, and too thin on others. Anodes made in special shapes were found not to be the complete answer.

THE ANSWER: By using lead coated copper, current could be "aimed" with greater precision. Hot dip lead coatings on the copper were not satisfactory. They were too thin, too porous, and pitted too quickly.

Lead plating the copper anodes in Harshaw Lead Fluoborate Solution was the answer. It gave a dense, easily-controlled lead surface of uniform thickness. And when pitting occurred, it was a simple matter to replate. Furthermore, these lead plated copper anodes were lighter, smaller in cross section, and carried the required current where it was needed.

Here are a Few Other Wartime Uses for Lead Plating:

Adapters and linings of gas shells
Pipes and pipe fittings in contact with corrosive vapors and liquids
Gas mask parts
Coil springs
Aircraft engine bearings and parts
Marine and Naval equipment
Cables, channel irons
Screws, bolts, nails
On all metals where the lubricating, vibration-dampening or corrosion-resisting properties of lead may be used.

★

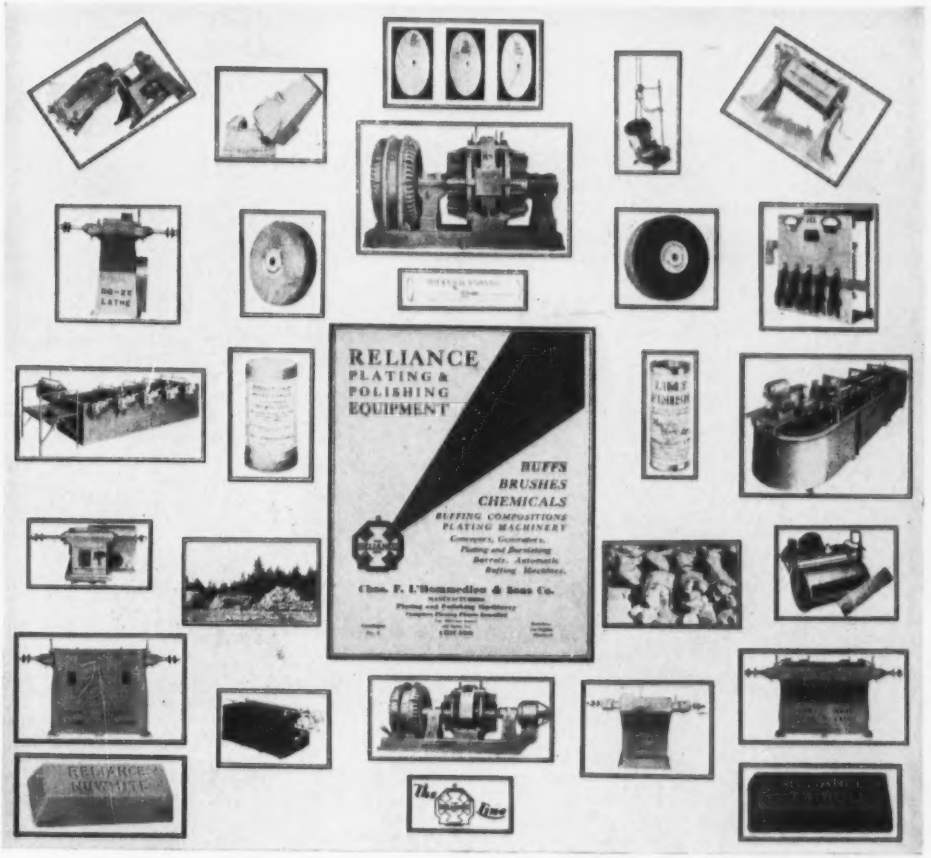
A new 8-page booklet on Lead Plating with Harshaw Lead Fluoborate Solution Concentrate has just come off the press. It describes everything from solution preparation to solution analysis. Write for your copy . . . a post card will do.

★

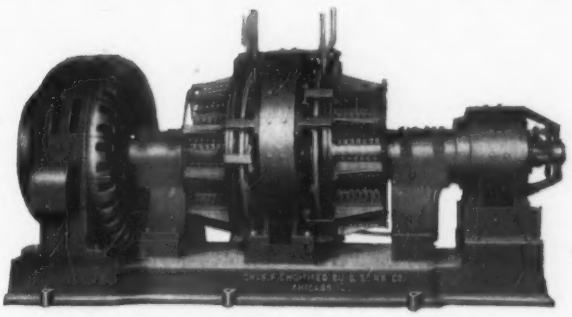
HARSHAW

THE HARSHAW CHEMICAL CO.
1945 E. 97th Street, Cleveland, Ohio
BRANCHES IN PRINCIPAL CITIES

QUALITY PRODUCTS



EVERYTHING FOR PLATING AND POLISHING



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Complete Plating Plants Installed

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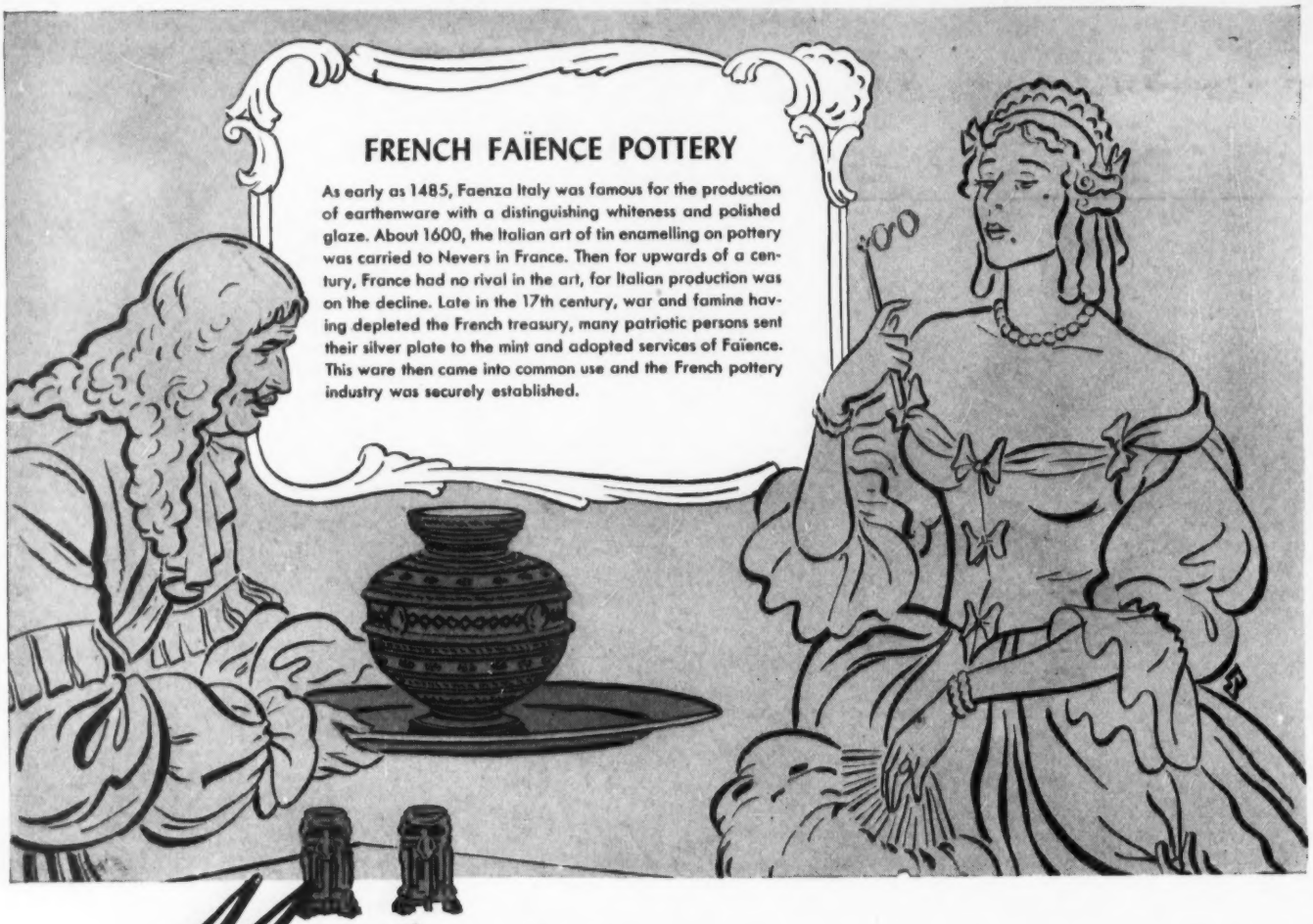
EVERYTHING IN EQUIPMENT AND SUPPLIES FOR PLATING AND POLISHING

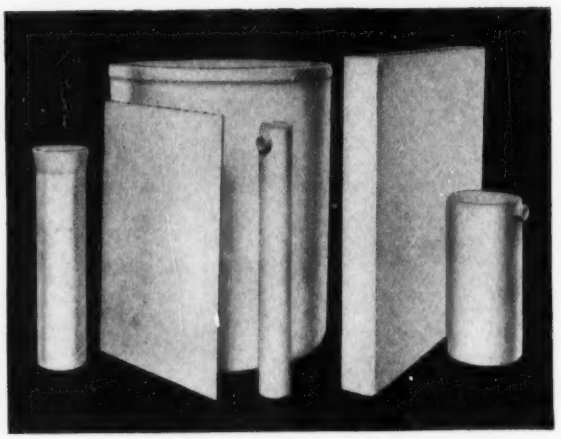

FRENCH FAÏENCE POTTERY
As early as 1485, Faenza Italy was famous for the production of earthenware with a distinguishing whiteness and polished glaze. About 1600, the Italian art of tin enamelling on pottery was carried to Nevers in France. Then for upwards of a century, France had no rival in the art, for Italian production was on the decline. Late in the 17th century, war and famine having depleted the French treasury, many patriotic persons sent their silver plate to the mint and adopted services of Faïence. This ware then came into common use and the French pottery industry was securely established.

Masterpieces OF POTTERY

IN THE 17TH CENTURY, pottery came into common use by the French people because of famine and depression. The birth of Chemical Stoneware, on the other hand, grew out of an advancing civilization. Its development was brought about through the stimulus of chemical advancement—the handling, in great quantities, of strong chemicals and corrosive liquids, requiring equipment that was non-corroding.

General Ceramics Chemical Stoneware, in addition to being acid-proof throughout, is built to withstand the roughest handling. Its glazed surface is easy to keep clean, thus eliminating product contamination.

General Ceramics products include acid-proof pipe, valves, fittings, kettles, jars, pots, pumps, exhausters, coolers, condensers, acid elevators, towers, filtering equipment and tourills.



Ceraphragms—the new porcelain-like porous diaphragms for electrolysis

Other products include Steatite Insulators made by General Ceramics & Steatite Corp., Keasbey, N. J.

General Ceramics Co.

GENERAL CERAMICS COMPANY
CHEMICAL STONEWARE

CHEMICAL STONEWARE DIV.
KEASBEY • NEW JERSEY

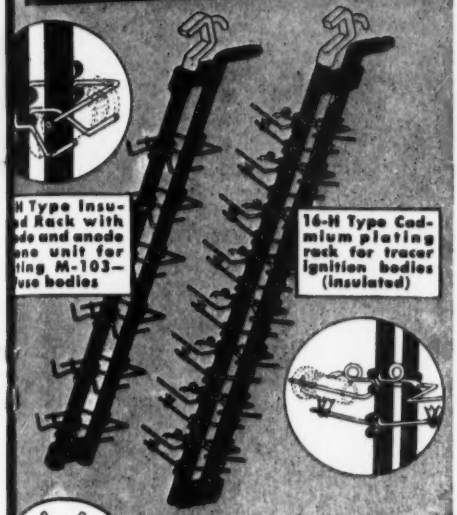
FD 3949

Insist On Genuine

BELKE PLATING RACKS

New — Wonderful Synthetic Insulation

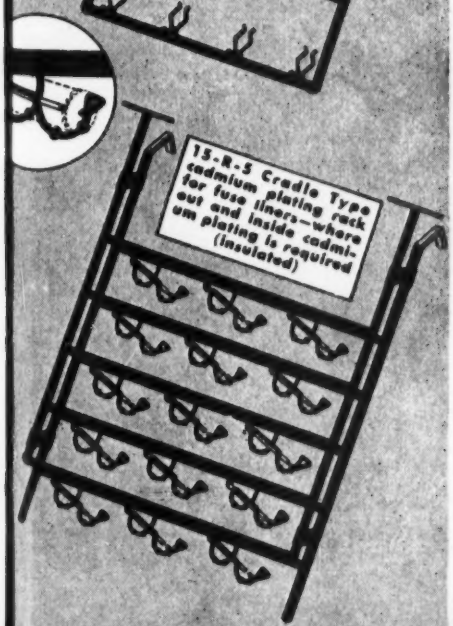
FOR ANODIZING



H Type Insu- d Rack with ode and anode ne unit for ting M-103— use bodies

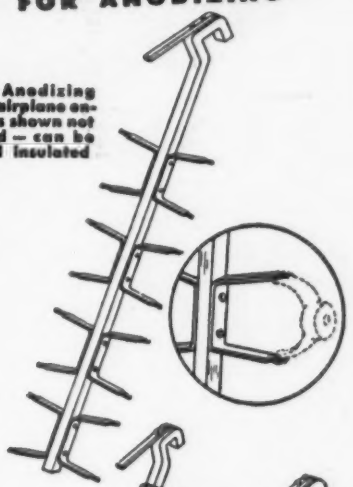
16-H Type Cadmium plating rack for tracer ignition bodies (insulated)

R-3-Type rack for ing M-48 Fuse (insulated)

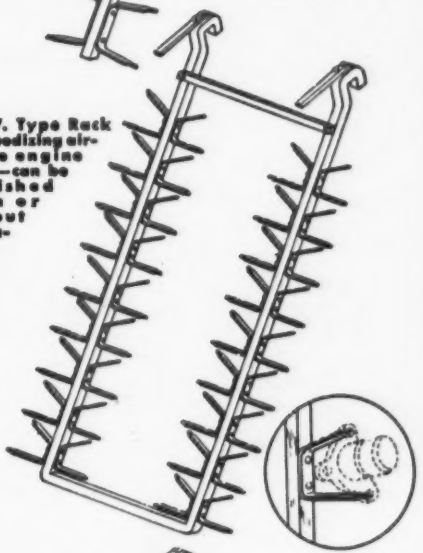


15-R-5 Cradle Type cadmium plating rack for fuse liners—where out and inside cadmium plating is required (insulated)

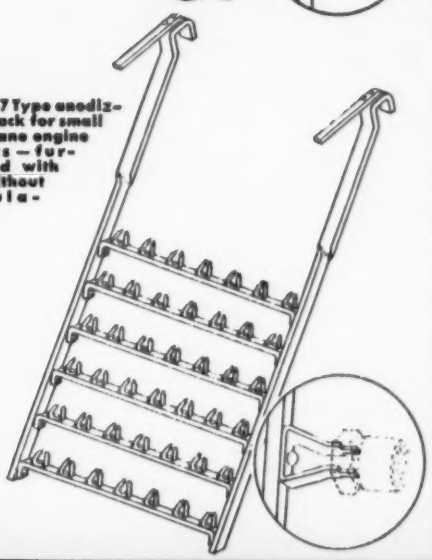
8-H Type Anodizing Rack for airplane engine parts shown not insulated — can be furnished insulated

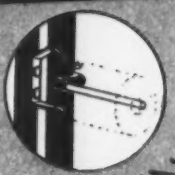


36-LV. Type Rack for anodizing airplane engine parts—can be furnished with or without insulation

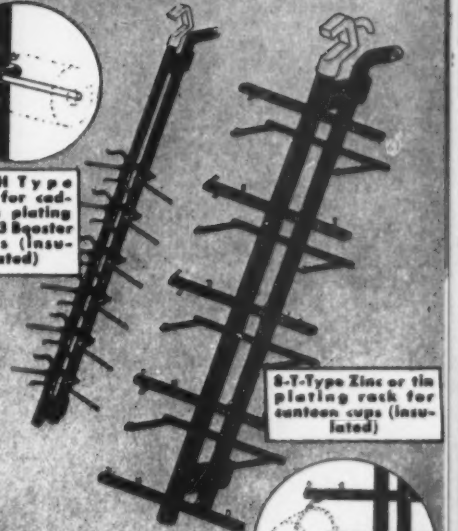


42-R-7 Type anodizing rack for small airplane engine parts — furnished with or without insulation

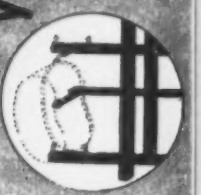




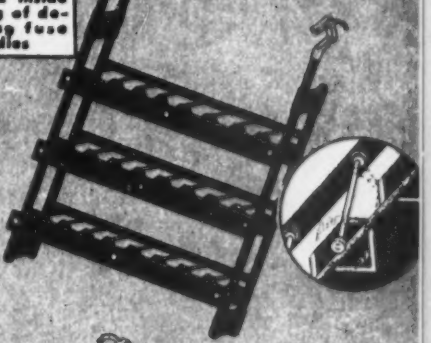
12-H Type rack for cadmium plating M-103 Booster cases (insulated)



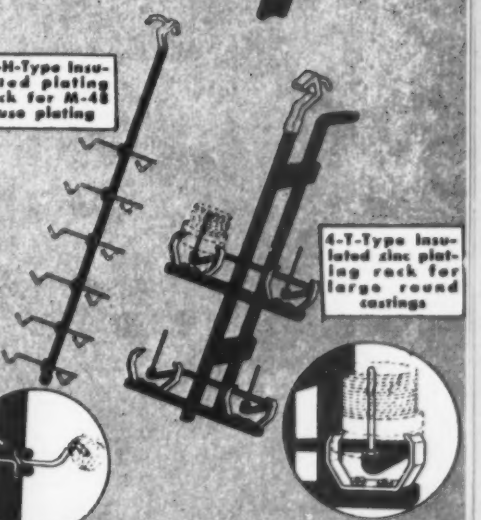
8-T-Type Zinc or tin plating rack for canteen cups (insulated)



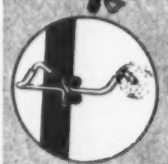
30-R-3 Type insulating rack for cadmium out and inside plating of detonating fuse bodies



12-H-Type insulated plating rack for M-48 fuse plating



4-T-Type insulated zinc plating rack for large round castings



BELKE MANUFACTURING COMPANY

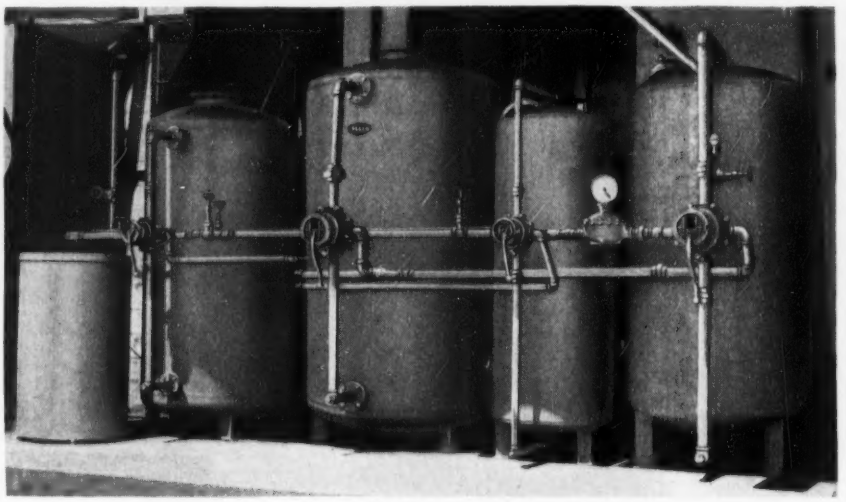
947 NORTH CICERO AVENUE · CHICAGO

PURE WATER FOR PLATING

at a fraction of former costs!

De-ionized water (comparable to distilled water, but at a fraction of its cost) in plating solutions and in pre-rinse tanks eliminates the troubles due to mineral salts in water supply. Ion-exchange resins can also be used to reclaim precious metals now being washed away in solution. Pioneers in the manufacture of De-ionizing equipment, ILLCO has been called on to supply pure water in a number of plating departments, and users are enthusiastic about results. . . . Without *heat*, without fuel, ILLCO-WAY De-ionizing units are daily producing pure water to meet exacting industrial and technical standards in leading U. S. plants.

TESTED IN THE LABORATORY
ILLCO-WAY
PROVED IN THE FIELD



Typical ILLCO-WAY unit in aircraft factory. Capacity: 2,000 gallons of De-ionized water an hour. Other units have permissible flows of from 100 gallons to 50,000 gallons per hour. Similar equipment is used for plating and anodizing.

NEW CHEMICAL METHOD REPLACES DISTILLED WATER! This modern, economical method is based on ion exchange, and uses Amberlite resins. Cost of the treated water is remarkably low—only a few cents per thousand gallons. . . . Learn how ILLCO-WAY equipment can speed production, help cut costs in *your* plant! Write for literature today!

ILLINOIS WATER TREATMENT CO.

856 CEDAR STREET, ROCKFORD, ILLINOIS

WATER TREATMENT ENGINEERS

BUCKINGHAM COMPOUNDS

NOW USED IN

WAR PRODUCTION

BURRING • GREASELESS

HARDENED STEEL COMPOSITION

Samples Shipped Promptly

THE BUCKINGHAM PRODUCTS CO.

8900 HUBBELL AVE. DETROIT, MICH.

UNITED CHROMIUM is helping to shape its progress

The use of chromium plating in connection with wearing surfaces in internal combustion engines is writing history today! This contribution to the war effort will stand as one of the important accomplishments of the electroplating industry in the present emergency. Results of its application and use are of great importance, and United Chromium has an important part in shaping these events.

United Chromium makes available to its licensees the results of research and development work carried on over a period of many years — our experience accrues to the benefit of our licensees to assist them in using chromium plating to the greatest advantage, including the use of the type of deposit frequently referred to as "porous chromium". The effective way in which these developments can be utilized is demonstrated by the accomplishments of those licensees who are today in production.

An inquiry to any office below will receive prompt attention

UNITED CHROMIUM
INCORPORATED

51 East 42nd Street, New York, N. Y.
2751 East Jefferson Ave., Detroit, Mich.
Waterbury, Conn.

MINUTES instead of HOURS to dry..

..your POLISHING WHEELS with this

Park INFRA-RED DRYER

Now it is possible for you to dry your polishing wheels in minutes instead of hours after application of "head". This is a definite saving of production time over the old method of drying in ovens which usually took twenty-four hours, and required a larger wheel inventory. This PARK INFRA-RED DRYER (patented) requires the minimum of floor space (unit is only 54" square by 66" high) and is furnished with casters so that it can be easily moved out of the way when not in use. Cut down on your wheel inventory with this Park Dryer, by using the same wheel more than once in a single day—write or wire for complete specifications and prices today!

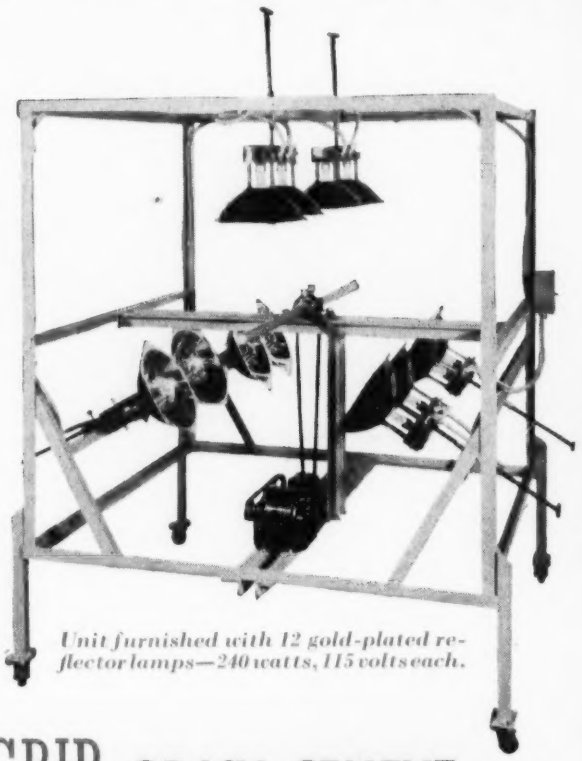
• • •

1 Even drying is guaranteed.

2 Lamps are adjustable to any distance from the wheels.

3 Various diameter wheels can be mounted on the drying shaft by use of special bushings.

4 Casters furnished with each unit for portability.



Unit furnished with 12 gold-plated reflector lamps—240 watts, 115 volts each.

Park KOLD GRIP GRAIN CEMENT

Park's Kold Grip grain cement is a highly efficient *cold* cement *binder* used to attach abrasive grains to the face of a polishing wheel or belt, and also to cement wheel sections together. Park Kold Grip grain cement can be used as a substitute for glue in setting up any size polishing wheel. It is clean, odorless and is not subject to bacterial attack. Available in 5 or 55 gal. drums.

DELIVERY *Reasonably fast delivery can be made on both the Infra-Red Dryer and Kold Grip grain cement with necessary priorities.*

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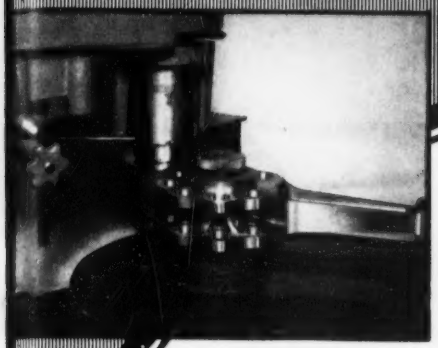

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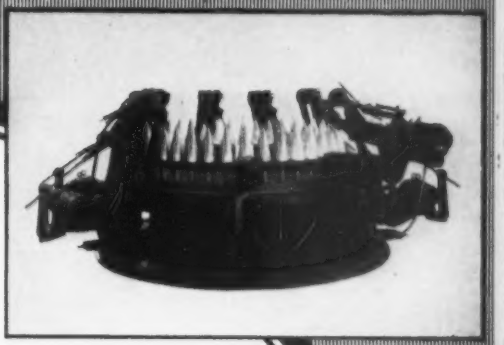

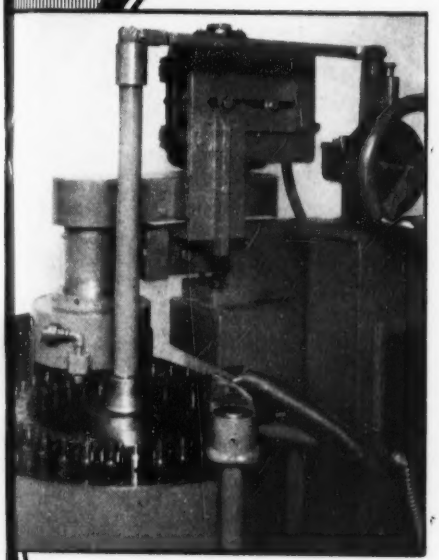

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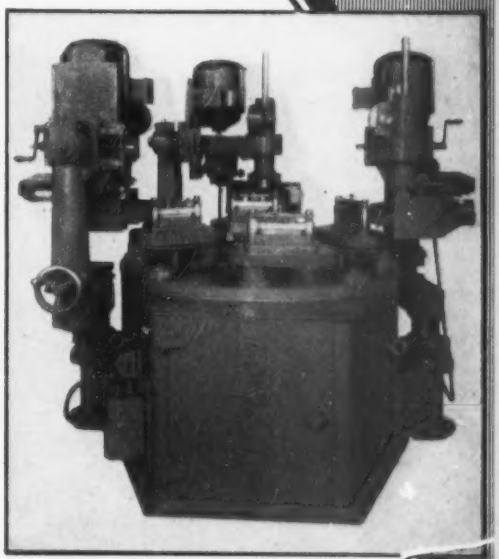

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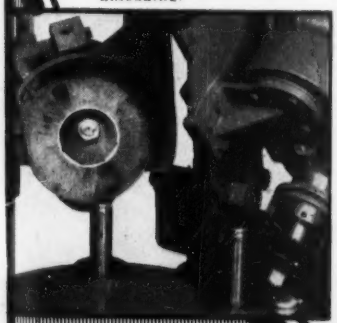

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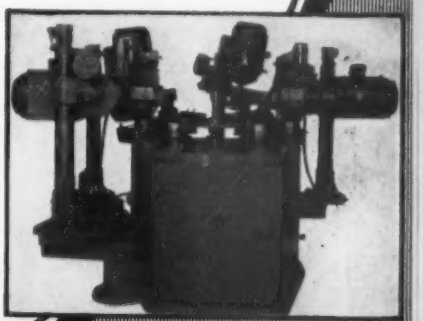

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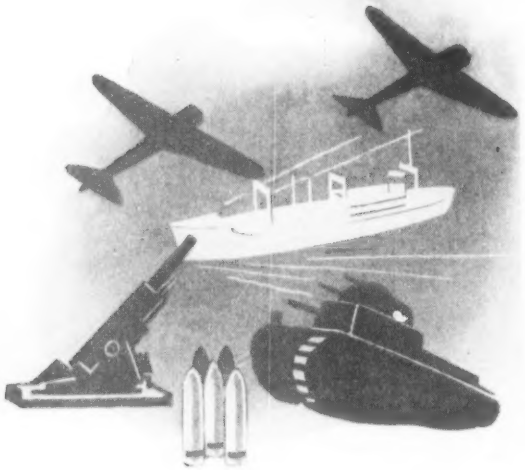

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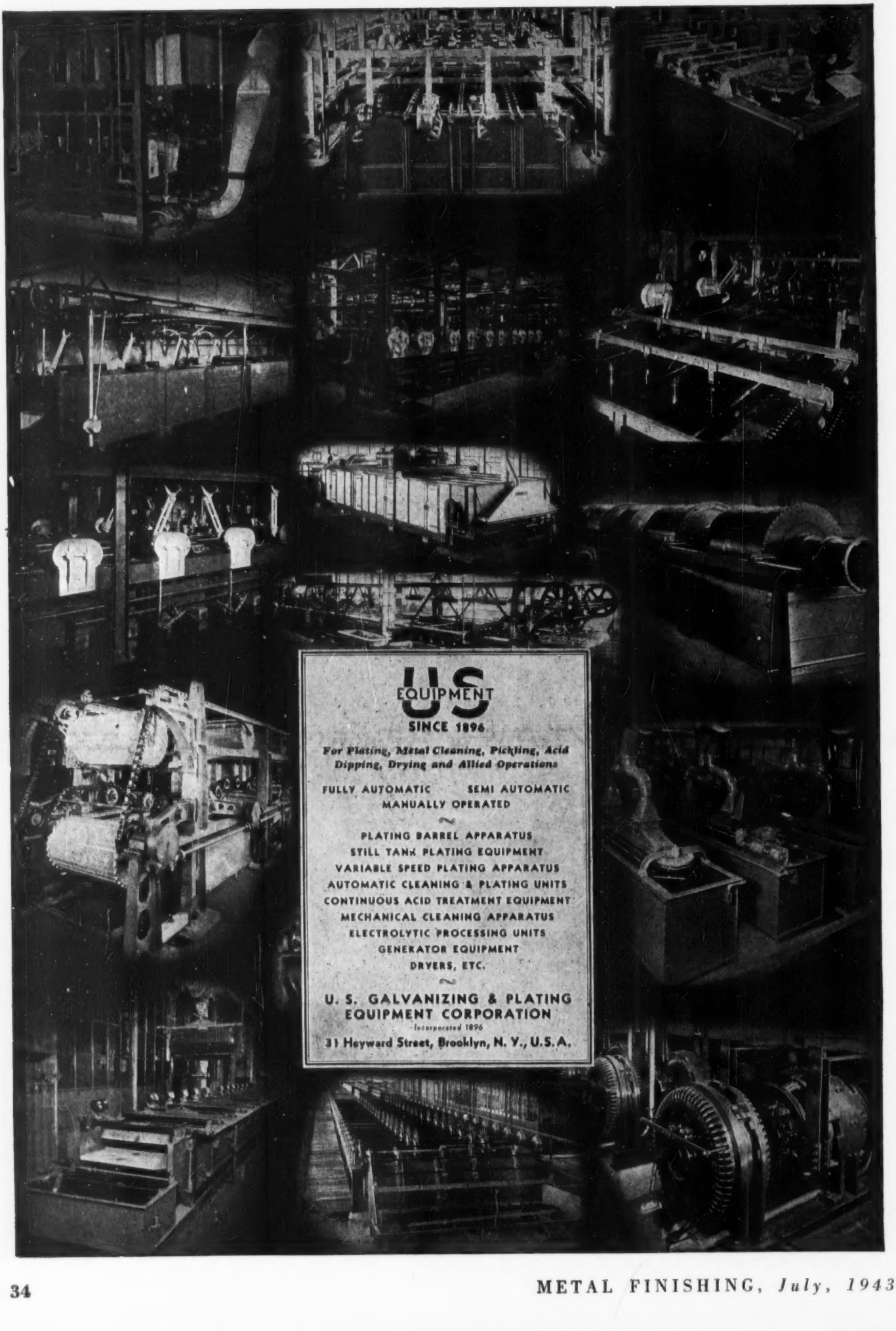
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THOMAS A. TRUMBOUR
Business Manager

NATHANIEL HALL and G. B. HOGABOOM, Jr.
Associate Editors

PALMER H. LANGDON
Assistant Editor
Corps of Engineers, U. S. Army

JOAN TRUMBOUR
Advertising Manager

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VOL. 41, NO. 7 METAL FINISHING JULY, 1943
PREPARATION, ELECTROPLATING, COATING

Technical Meetings in Wartime

A good deal has been written and a number of logical arguments have been advanced in connection with the desirability of discontinuing the holding of conventions for the duration. However, the 31st annual convention of the American Electroplaters' Society in Buffalo last month saw the previous record for attendance exceeded by more than 25 per cent despite transportation difficulties and the pressure of war work.

The gathering should have been more properly called a "technical meeting" rather than a "convention" since the latter word is usually associated in the public mind with an event predominantly social in nature. That this meeting was not a social affair can readily be deduced from a perusal of the educational program which included the presentation of 29 technical papers in only three days, an average of almost ten papers per day.

Through no stretch of the imagination could sitting through ten talks and their associated discussions in a single day be considered anything else but work—hard work, indeed. The fact that the seats at the educational sessions generally were well filled would indicate the interest of most of the registrants.

Although we are in favor of eliminating all unnecessary travel, meetings such as these offer a definite contribution in the opportunity afforded for the exchange of ideas. Technical developments can be brought to the attention of the industry in written form, obviating oral presentation and technical meetings for this purpose, but a good part of the application of metal finishing technique is in the nature of an art rather than a science and proficiency in an art cannot be imparted by the printed word.

A.E.S. CONVENTION BREAKS AI

Walter L. Pinner
Supreme Third Vice President

Ellsworth T. Candee
Executive Secretary

The 31st Annual Meeting of the American Electroplaters' Society, held in Buffalo, N. Y., June 7th, 8th and 9th, broke all records for attendance since the founding of the Society with a registration of 917, topping by almost 200 the previous record of 721 established at the Boston Convention in 1941.

Naturally, war work held the limelight during all the educational sessions with the subject of hard chromium plating producing the greatest interest.

On Monday, the educational session opened with a view of military requirements offered by *Dr. William Blum* of the National Bureau of Standards and *William McCord* of the War Production Board.

The outstanding event of the meeting probably was the Tuesday noon Victory Luncheon at which talks were given by *Dr. Frederick A. Hodge* and the *Hon. Samuel B. Pettingill*, former Congressman from Indiana, who appeared through the courtesy of Poor & Co., North Chicago, Ill.

Election of Officers

All the vice-presidents of the 1942-3 season were elevated one degree in rank; thus, *George Wagner* of Hy-Grade Electroplating Co., Newark, N. J., was elected Supreme President; *Maurice R. Caldwell*, chemist of W. B. Jarvis Co., Grand Rapids, Mich., was elected First Vice-President; *Clarence C. Helmle*, electrochemist of General Electric Co., Bridgeport, Conn., was elected Second Vice-President, and

SALL ATTENDANCE RECORDS

George Wagner
Supreme President

Walter L. Pinner, chief engineer of Houdaille-Hershey Co., Detroit, Mich., was elected Third Vice-President. *Ellsworth T. Candee,* Metal Hose Branch, American Brass Co., Waterbury, Conn., was appointed Executive Secretary.

All the officers are very well known in the metal finishing field and have made important contributions to the science.

Convention City

The Cleveland Branch was awarded the convention for 1944. However, if hotel accommodations for the visitors do not become available, the meeting may be transferred to Detroit where the Statler Hotel has stated they will be able to arrange for adequate facilities.

Clarence C. Helmle
Supreme Second Vice President

Maurice R. Caldwell
Supreme First Vice President

Prize Awards

The Committee on Prize Awards made good choices for the recipients of the various prizes.

THE HERMINIE DOROTHEA PROCTOR AWARD OF $100.00

Awarded to *R. A. Schaefer* and *J. B. Mohler* of the Cleveland Graphite Bronze Co., Cleveland, O., for their paper entitled "Rapid Silver Plating".

Frank Mesle
Winner of Founders' Gold Medal.

FOUNDERS' GOLD MEDAL

Awarded to *Frank Mesle* of Oneida, Ltd., Oneida, N. Y., for his paper entitled "Study of the Adherence and Corrosion Resistance of Silver Plate on Steel".

HONORABLE MENTION: *Austin F. Fletcher*, The Brewer-Titchener Corp., Binghamton, N. Y., for his paper entitled "The Hand Chrome Plating of Cutting Tools".

Also, *F. MacIntyre* and *R. O. Hull*, The du Pont Co., Electroplating Division, Cleveland, O., for their paper entitled "Plating Test Control of Plating Baths".

FIFTY DOLLAR PRIZE FOR BEST PAPER IN THE MONTHLY REVIEW

Awarded to *Dr. W. A. Wesley* and *E. J. Roehl* for their paper entitled "Reclaiming Nickel from Idle Plating Baths" which appeared in the November, 1942 issue of *The Monthly Review*.

R. O. Hull
Co-winner with F. MacIntyre of Honorable Mention in Founders' Gold Medal Award.

Austin F. Fletcher
Honorable Mention in Founders' Gold Medal Award.

Dr. W. A. Wesley
Co-winner with E. J. Roehl of $50 prize for Best Paper in *The Monthly Review*.

A. E. S. GOLD MEDAL

Awarded to *Walter L. Pinner*, Houdaille-Hershey Co., Detroit, Mich., for his paper entitled "Recovery of Nickel from Obsolete Nickel Plating Solution" which appeared in *The Monthly Review*, Oct., 1942.

HONORABLE MENTION: *Clarence Helmle* for his paper entitled "Ceramic Coating of Electrodeposited Silver," which was published in *The Monthly Review*, Nov. 1942, and *Joseph B. Kushner* for his paper, "Drag-In" in the Sept., 1942 issue.

Branch Awards

The trophy for the greatest increase in membership during the past year was awarded to Syracuse Branch. The prize for the best exhibit was awarded to Bridgeport Branch.

Dr. Walter R. Meyer
Winner of 1st Prize for Technical Photographs.

Photographic Exhibit

An interesting series of photographs was displayed at the second annual photographic exhibition held at the meeting. The awards were as follows:

Manufacturers' Photographs of Equipment and Processes:

1st Prize: *Hanson-Van Winkle-Munning Co.*, Matawan, N. J.

2nd Prize: *Detroit Rex Products Co.*, Detroit, Mich.

3rd Prize: *The Lea Manufacturing Co.*, Waterbury, Conn.

Photographs of Finishes — Production Technique:

1st Prize: *F. Schladen, McDaniels* and *Neill.*

2nd Prize: *A. Boggild* and *V. Consalvo.*

Human Interest

1st Prize: *C. M. Douglas.*
2nd Prize: *Dr. K. Schumpelt.*
3rd Prize: *M. Thompson.*

Still and Animal Life

1st Prize: *W. L. Patton.*
2nd Prize: *Dr. L. M. McKinlay.*
3rd Prize: *M. Thompson.*

Landscapes, Views, etc.

1st Prize: *Dr. L. M. McKinlay.*
2nd Prize: *W. L. Patton.*
3rd Prize: *Dr. K. Schumpelt.*

Hobbies and Tabletops

1st Prize: *O. R. Olsen.*

Past Convention Pictures

1st Prize: *Arthur McNeil.*
2nd Prize: *William Hart.*

Technical Photographs

1st Prize: *Dr. W. R. Meyer.*
2nd Prize: *Hanson-Van Winkle-Munning Co.*, Matawan, N. J.

International Fellowship Club

As usual, the activities of the International Fellowship Club were very successful as all those who attended the Open House Monday night can testify. The club sponsored the Open House Meeting with a large number of organizations engaged in the production and distribution of plating supplies participating.

The annual Fellowship luncheon was held at noon on Monday when officers for the 1943-4 were elected. The elections were: Chairman—*"Bill" (W. M.) Cole*, Wyandotte Chemicals Corp., J. B. Ford Division, Wyandotte, Mich.; First Vice-Chairman — *Frederick Gumm*, Frederick Gumm Chemical Co., Kearny, N. J.; Second Vice-Chairman — *W. Douglas MacDermid*, MacDermid, Inc., Waterbury, Conn. *Thomas A. Trumbour* was continued in the office of Permanent Secretary.

"Bill" (W. M.) Cole
Chairman.

W. Douglas MacDermid
2nd Vice-Chairman.

Frederick Gumm
1st Vice-Chairman.

Thomas A. Trumbour
Permanent Secretary.

Lead Plating

By MYRON B. DIGGIN

Chief Chemist, Hanson-Van Winkle-Munning Co., Matawan, N. J.

THE use of electrodeposited lead as a substitute for more critical metal coatings is expanding rapidly and from present indications will assume considerable proportions during the war period. Aside from its use in refining on battery clips, brine tanks, a few ordnance parts and more recently, engine bearings, electrodeposited lead has not found favor with platers partly because of its physical properties, particularly appearance and softness, and to some extent because of unfamiliarity with the operating characteristics of the bath. Another serious hindrance to the use of the solution is the extremely disagreeable and hazardous task of preparing the solution from the basic chemicals.

Lead deposits can be used for the protection of iron and steel against corrosion and to obtain a corrosion-resistant coating on non-ferrous metals. There are many special applications, such as resistance to chemicals or severely corrosive atmospheres, where lead deposits are superior to cadmium and zinc provided sufficiently heavy and pore-free coatings are applied. Aside from these special applications, electrodeposited lead is now being substituted for cadmium and zinc coatings where corrosion under ordinary conditions of exposure is encountered.

A manufacturer contemplating making a change from cadmium or zinc coatings to electrodeposited lead is naturally interested in the comparative protective values of the metals. From its position in the electrochemical series one would assume that lead is cathodic to iron or steel and that therefore lead deposits should accelerate corrosion of the underlying steel if pores or bare areas are present, although to a lesser extent than copper. There is evidence that under some conditions of exposure, particularly in a marine atmosphere, lead is weakly anodic to steel and therefore will exert electrochemical protection.[1]

In view of the fact that lead coatings under many conditions are definitely cathodic and because platers and engineers have had limited experience with electrodeposited lead in comparison with cadmium and zinc deposits, it is definitely safer not to rely upon lead furnishing electrochemical protection. If an extra dividend in protection is obtained under certain conditions of exposure, no harm results; but, on the other hand, if sacrificial corrosion is expected in specifying the thickness of coating, failures may unexpectedly occur. Bearing this in mind we should strive for the same qualities in lead deposits as we have learned to recognize as important in depositing definitely cathodic metals such as nickel or copper, where, for reasonable protection as compared with cadmium or zinc, the deposits must be heavy, mechanically sound, and free from inclusions and pores.

Thickness of Deposit

As previously mentioned, experience with electroplated lead coatings from modern solutions has been so limited that a manufacturer who contemplates the substitution of lead for cadmium or zinc is at loss to know what thickness should be specified as compared with thickness of cadmium or zinc found to be satisfactory by actual service tests.

Accelerated tests such as salt spray are misleading and cannot be interpreted in terms of expected life under any conditions of actual atmospheric exposure. Blum and coworkers[2] mention that deposits with a thickness of around 0.003″ are substantially non-porous while Gray & Blum[3] point out that bolts and nuts are usually plated with a thickness of 0.0005″ to 0.008″, depending upon conditions of exposure. One suspects that the heavier thicknesses are for special service in contact with chemicals and corrosive fumes. For twelve years the writer has observed the lead plating of cast iron clutches on plating apparatus. It was found that on this type of metal and with exposure to the usual plating room atmosphere, a deposit of 0.002″ is serviceable, especially if the deposits are scratch brushed lightly after plating.

Soderberg[4] in a recent paper gives an excellent bibliography of atmospheric, indoor, and salt water corrosion tests on lead coatings. Some of the electroplating baths mentioned and the conditions of exposure cited in the references are not in common use in this country. The author mentions results of tests on deposits produced in a glue-containing lead fluoborate solution. The panels were exposed at a 45° angle facing south in an industrial atmosphere. It is stated that steel panels with 0.00025″ lead showed rust after three months and that after six months an average of six per cent of the top surfaces and 45 per

cent of the bottom surfaces were rusted. In the same test, panels with 0.0005″ and 0.001″ of lead were substantially free from rust after six months' exposure.

The issuance of emergency specifications for electrodeposited lead coatings on steel is now being considered by the American Society for Testing Materials.

Because of the lack of extensive corrosion data on the protective value of lead deposits under various conditions of exposure and also because of our limited knowledge of conditions affecting the lead electrodeposition processes in use today, it would be presumptious to state that a certain thickness of electroplated lead could be substituted for, and would be equivalent to, a definite coating thickness of cadmium or zinc. Even with our present experience and knowledge of cadmium and zinc processes, there are conditions of exposure where, knowing the service one metal can be expected to give, it would be unwise to equate this to a certain thickness of the other coating.

For indoor exposure away from corrosive fumes, where 0.0001-0.0002″ of cadmium or zinc has been found satisfactory, the writer suggests the use of lead coatings with a thickness of 0.0002-0.0003″. For outdoor exposure, lead thicknesses of under 0.0005″ should not be considered unless the articles are to be lacquered or painted. Incidentally, paint coatings adhere exceptionally well to electrodeposited lead. Prolonged protection of surfaces exposed to weather requires 0.001-0.002″. Similar thicknesses are suggested for indoor exposure in a corrosive atmosphere.

Severely corrosive conditions may require even heavier coatings—up to 0.003-0.004″. Lightly burnishing or scratch brushing the lead surfaces after plating will improve the corrosion protective qualities. These suggestions are tentative and must be supplemented by careful observation of the parts in actual service. To anyone who has operated lead plating solutions it is quite apparent that the throwing power is markedly lower than in cadmium and zinc solutions. In lead plating formed articles where the protection on the recessed areas is important, a heavier overall thickness must be applied unless it is feasible to use auxiliary anodes. Furthermore, heavier thicknesses must be applied if the articles are handled carelessly or are subject to abrasion. Lead deposits are softer and more easily deformed than any of the commonly plated metals. Merely tossing a plated article into a tote box may gouge the coating down to the base upon which it is plated. Even wrapping a lead plated sample in tissue paper produces a mild burnishing action on the surface.

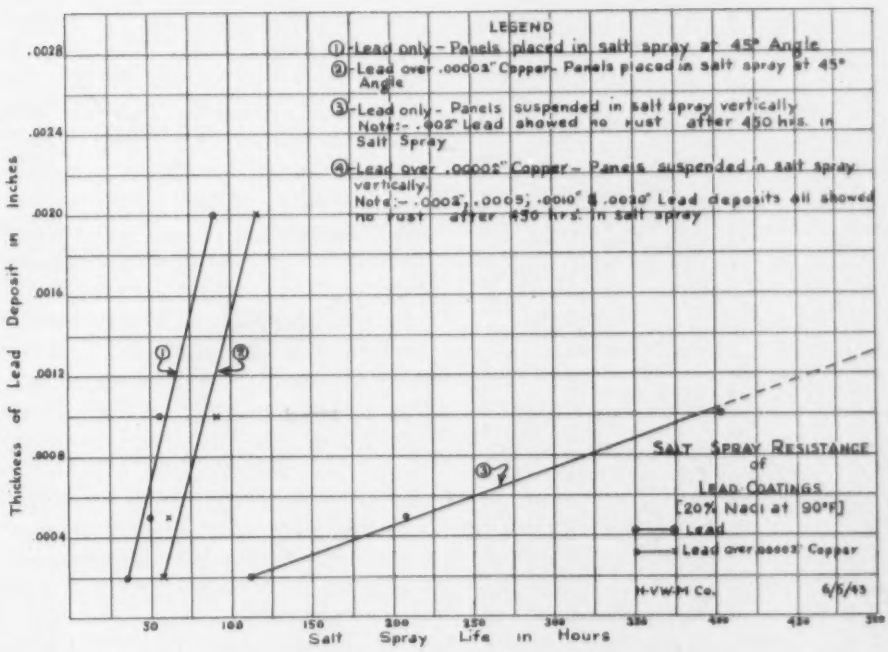


Fig. I. Salt spray resistance of lead coatings.

For those platers who attach significance to salt spray resistance, the expected life of lead coatings of various thicknesses before the appearance of rust is shown in Figure I. Cold rolled steel panels plated with 0.0002″ of lead from the fluoborate solution break down in 31 hours when suspended at a 45° angle in the salt spray cabinet. The application of a copper flash (0.00002″) increases the life under the same conditions of exposure to 57 hours. From the slope of curves 1 and 2 on Figure I, it is evident that doubling the thickness of the lead deposit produces only a slight improvement in salt spray resistance.

Curve 3 illustrates the effect of salt spray exposure conditions upon the life of a lead coating plated directly on steel. In this case the panels were hung vertically in the salt spray cabinet. Curve 4 is not shown as by copper flashing (0.00002″) the panels before applying the lead, the thinnest panels of the series (0.0002″ of lead) did not show rust until 540 hours when hung vertically in the cabinet.

It is interesting to note that increasing the thickness of deposit on vertically hung panels produces a remarkable increase in salt spray resistance as compared with effect of increasing thicknesses on panels exposed at a 45° angle.

Plating Solutions

Of the many types of lead solutions proposed and used since the turn of the century, the lead fluoborate bath has evolved as the most practical process for commercial electroplating, although the use of the recently-introduced lead sulfamate solution is increasing. The fluosilicate solution, used largely for electrorefining, is a less expensive solution initially but is unstable and cannot be safely applied to steel without an intermediate copper flash.

An alkaline lead plating solution will be introduced shortly. The throwing power of this solution is superior to that of acid solutions. An important advantage of the alkaline bath at the present time is that it can be used in unlined steel tanks. Conversions from cadmium and zinc plating to alkaline lead plating involves no major changes in equipment or procedure.

The fluoborate solution is essentially lead fluoborate, $Pb(BF_4)_2$ stabilized with an excess of free fluoboric and

boric acids. Colloidal addition agents are required to mimimize roughness, to produce a finer crystalline structure and to prevent treeing. Formulas are given in a number of publications[6] for the preparation of fluoborate lead solutions. In preparing a lead solution from basic lead carbonate, hydrofluoric acid, boric acid and glue, an analysis should be made of the first two constituents to determine the actual composition. The metallic lead content of basic lead carbonate from different sources may vary. The actual hydrofluoric acid concentration and the percentage of sulphate in the hydrofluoric acid must be taken into consideration. The presence of sulphates in either the hydrofluoric acid or make-up water will cause some of the lead to be precipitated as insoluble lead sulfate. If animal glue is used as the addition agent it should be thoroughly tested for its effect in a small plating solution before adding it to the entire batch. A Hull cell test is suggested. A microscopic examination at 500 diameters of the deposits produced with an unsatisfactory grade of glue (or an excess of a grade known to be satisfactory) will reveal many dark-colored inclusions and in some cases a powdery-appearing surface. After all of the make-up chemicals have reacted and before the colloidal addition agent is added, the solution should be filtered using a suitable grade of filter-aid to obtain maximum solution brilliance.

Lead fluoborate baths should not be operated with a metal concentration of less than 16 ounces per gallon, where moderately heavy deposits are required or where the utmost in smoothness and throwing power is desired. For building up heavy deposits, the metal concentration can be doubled. The "free" or excess fluoboric acid concentration as determined by analytical methods given below, is usually maintained at from 2.5-4 ounces per gallon depending upon the metal concentration chosen. It should be emphasized that proportions of basic chemicals must be chosen so that no uncombined hydrofluoric acid is present. The presence of as much as two ounces per gallon of uncombined boric acid has been found to have a stabilizing effect upon the bath in that the precipitation of lead fluoride is retarded. The glue concentration at which the smoothest deposits are obtained is between 0.02 and 0.04 ounces per gallon.

If operated with reasonable care, fluoborate lead plating solutions are appreciably more stable than cyanide plating baths. It is desirable to be able to control the composition, however, to secure consistent performance. Analytical control methods are given below:

Analysis of Fluoborate Baths

Lead:

This procedure is based on the precipitation of lead as lead sulfide in alcoholic solution, filtration and subsequent determination of the lead as lead chromate.

1. Weigh one gram of the sample into a 250 ml. beaker. Add 50 ml. of 90% ethyl alcohol (9 volumes of 95% alcohol plus one volume of water).*
2. Pass H_2S into the solution until all of the lead is completely precipitated.
3. Filter off the PbS. Wash with 90% alcohol, reserving the filtrate for BF_4. Remove the beaker containing the filtrate and wash the PbS twice with hot water to remove the alcohol.
4. Perforate the paper and wash the PbS into a beaker with a stream of water. Wash the paper with (1:3) HNO_3 and finally with hot water.
5. Heat to boiling until all of the PbS is dissolved. Filter if necessary.
6. Make the solution ammoniacal, then slightly acid with acetic acid.
7. Add 5 g. of ammonium acetate. Heat to boiling, then add an excess of 5% potassium dichromate. Boil for a few minutes.
8. Allow the precipitate to settle completely. Filter on a weighed Gooch crucible and wash by decantation until washings are colorless, finally transferring all of the precipitate to the crucible.
9. Dry the precipitate to constant weight at 110°C. Cool and weigh $PbCrO_4$.
10. *Calculation*

$$\text{wt} \cdot \frac{\%\ \text{Pb as } Pb(BF_4)_2 = PbCrO_4 \times 1.178 \times 100}{\text{wt. of sample}}$$

* Most of the lead fluoborate will be precipitated by the alcohol but this is easily converted to PbS. The HBF_4 and H_3BO_3 (if present) stays in solution.

Fluoborate:

This procedure is based on precipitating the insoluble potassium fluoborate, and weighing the precipitate.

1. Treat the filtrate from the lead determination by bubbling air through it to remove the H_2S.
2. Add a saturated solution of KCl dropwise until no further precipitation occurs. Add 4-5 drops ex-

TABLE I
Time Required to Deposit a Given Thickness of Lead Based on Cathode Efficiency of 98%

Amp./ sq. ft.	Thickness of Lead Deposit in Inches											
	.0001	.0002	.0003	.0004	.0005	.0006	.0007	.0008	.0009	.0010	.0015	.0020
	Time Required, Calculated in Hours and Minutes											
5	:08	:17	:26	:34	:42	:50	:58	1:06	1:14	1:25	2:07	2:49
6	:07	:14	:21	:29	:36	:42	:50	:56	1:03	1:10	1:46	2:21
7	:06	:12	:18	:25	:31	:37	:42	:48	:53	1:00	1:30	2:01
8	:05	:10	:16	:21	:27	:32	:37	:42	:48	:53	1:19	1:45
9	:05	:09	:14	:18	:23	:29	:34	:39	:42	:47	1:10	1:34
10	:04	:08	:12	:17	:21	:26	:30	:34	:38	:42	1:04	1:24
15	:03	:06	:08	:11	:14	:17	:20	:23	:27	:29	:40	:56
20	:02	:04	:06	:08	:10	:13	:15	:17	:19	:21	:32	:43
25	:02	:03	:06	:07	:08	:10	:12	:14	:15	:17	:26	:35
30	:01	:03	:04	:06	:07	:08	:10	:11	:13	:14	:21	:29
35	:01	:02	:04	:05	:06	:07	:08	:10	:11	:12	:18	:24
40	:01	:02	:03	:04	:05	:06	:07	:08	:09	:10	:15	:21
45	:01	:02	:03	:04	:05	:06	:07	:08	:09	:10	:15	:21
50	:01	:02	:03	:03	:04	:05	:06	:07	:08	:08	:12	:17
Oz./sq. ft.	0.06	0.19	0.28	0.38	0.44	0.57	0.66	0.76	0.85	0.95	1.42	1.90

cess. (Avoid large excess as KCl tends to precipitate with KBF_4).

3. Let the precipitate stand in an ice bath for two hours.
4. Filter on weighed Gooch crucible and wash with cold 90% alcohol until free of chlorides.
5. Dry to constant weight at 110°C. and weigh KBF_4.
6. *Calculations*

$$\% \ BF^-_4 \text{ as } Pb(BF_4)_2 = \frac{1.512 \times \text{wt. of } KBF_4 \times 100}{\text{wt. of sample}}$$

$$[BF^-_4 \text{ as } Pb(BF_4)_2 — Pb \text{ as } Pb(BF_4)_2] \times .4611 = \text{Free } HBF_4$$

Boric Acid:

1. This procedure is based on volumetric determination of boric acid in the presence of mannitol using phenolphthalein as an indicator.
2. To the filtrate from the fluoborate determination, add a few drops of methyl red indicator (0.1%) and make neutral with N/1 NaOH and then add 2 ml. in excess.
3. Transfer the solution to a casserole and boil off the alcohol.
4. Dilute the solution with water to 50 ml. and add hydrochloric acid (1:1) until the solution is just barely acid to methyl red.
5. Heat to a very gentle boil for 2-3 min. to remove the CO_2.
6. Cool. Neutralize with .1N NaOH to the first distinct yellow of the indicator. Read the burette.
7. Add 2 gm. of mannitol and 2 or 3 drops 0.5% phenolphthalein and titrate to the first permanent pink. Add another gram of mannitol and if this causes a disappearance of the end point, add more alkali until it reappears. The difference between the methyl red end point and phenolphthalein is alkali consumed by the boric acid.
8. Run a blank using the same amount of alcohol and NaOH beginning with step 3 above.
9. *Calculation*

$$\% \ H_3BO_3 = \frac{\text{(cc. 0.1N NaOH—cc. blank) x .00618 x 100}}{\text{wt. of sample}}$$

Operating Conditions

Where electrometric pH apparatus is available, the proper acidity can be controlled by adding fluoboric acid as required to maintain a pH of 1.0-1.5.

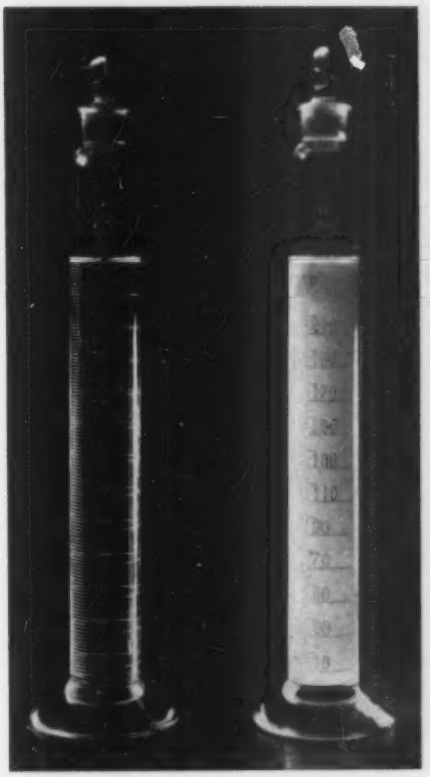
The control of the colloidal addition agent is more difficult. After a plater has become familiar with the lead plating process, he can usually determine the frequency and amount of additions by observation of the plated work as it comes from the bath. It is a better plan to make a small scale test in a jar or Hull cell where the operating conditions can be closely controlled. Inspection of the plated surface at 500 diameters magnification will reveal excessive concentrations of glue. An excess of glue produces a surface with many dark-colored inclusions.

Fluoborate lead solutions operate best when the cathode current density is within the range of 5-30 amperes per square foot. Even solutions with high metal concentrations (32 oz./gal. Pb) operate with less trouble and the distribution of deposit is more uniform if a moderate current density is employed. In plating aircraft bearings where uniformity of coating is critical, most lead solutions are operated at 7-15 amperes per square foot. With higher metal concentrations and with sufficient agitation, a current density of 80 amperes per square foot has been used for producing light deposits. The anode current density should be confined to the range of 10-25 amperes per square foot in unagitated solutions.

The cathode current efficiency of an uncontaminated lead solution is around 98 per cent. At this efficiency it requires 42 ampere minutes per square foot to deposit 0.0001 inch of lead. At a cathode current density of 15 amperes per square foot, it will require 2.8 minutes to deposit a thickness of 0.0001 inch, or 28 minutes for 0.001 inch.

The voltage required for still plating will depend upon the anode-cathode relationship, the solution composition and the current density employed. At 5-10 amperes per square foot, 1-1.5 volts are sufficient; at 10-20 amperes per square foot, 1.25-2.0 volts suffice. Above 20 amperes per square foot the voltage required may exceed two volts.

For barrel plating, a full six volts is satisfactory except where extremely light loads are being plated; in this case, it may be necessary to reduce the voltage to five or even four to prevent nodular growth or trees on protruding portions of the load.



Cylinder at left contains a filtered fluoborate lead solution. Cylinder at right shows precipitate formed when sulphate-containing tap water is added to clear fluoborate solution.

The operating temperature of the fluoborate bath is not critical. Neither heating nor cooling coils are required. Acceptable deposits are produced at temperatures ranging from 75-100° F.

Agitation is not required when plating at moderate current densities. Above 30 amperes per square foot, a cathode rocker or submerged solution agitator minimizes treeing on sharp corners or protruding areas. The distribution of the deposit is poor when using violent agitation combined with high current density. Air agitation is not recommended.

Anodes of the purest chemical lead are used. If possible, the copper content of the anodes should be lower than 0.02 per cent. It has been observed that the structure of the deposit is adversely affected when using anodes containing as little as 0.08 per cent copper. Other metallic impurities cause the anodes to scum. Although this condition does not seem to lead to higher voltage requirements, some of the particles may be washed from the

anodes and so cause rough deposits.

Tanks constructed of steel with either rubber or synthetic linings give excellent service. Asphaltum-lined wood tanks have been usd for lead baths, but may have a relatively short life. Existing lead lined tanks have been pressed into service where the delivery of more suitable equipment has been slow. Obviously, lead is not the ideal lining to use. It resists chemical corrosion in contact with the fluoborate solution but will probably enter the electrical circuit and become bipolar; anodic areas will then corrode away, eventually exposing the steel shell. This condition can be minimized by lining the tank with glass panels. Perhaps the best procedure where lead linings must be used is to apply a special synthetic resin primer followed by the application of a suitable plastic lining.

There are several synthetic plastic materials available which have given satisfactory service as linings for steel tanks. Experience with the same linings on wood tanks has been too limited to warrant recommending this combination. Tempered glass and ceramic tanks are suitable for use with properly prepared lead solutions.

Plating cylinders should be fabricated from suitable laminated plastics or hard rubber. In using barrel plating apparatus for lead solutions, the low pH must be considered. Cast iron gears, metal bolts and cover clamps exposed to the highly acid solution will be attacked.

The same care is required in preparing surfaces for lead plating as for nickel plating. Alkaline cadmium, zinc and copper solutions have a cleaning action which is lacking in acid solutions, such as nickel or lead. In general, anodic electrocleaning, rinsing, acid dipping or pickling in either hydrochloric or sulphuric acids followed by thorough rinsing is usually a sufficient treatment prior to lead plating. Castings should be well-cleaned by sand or shotblasting. A copper strike of about 0.00002″ is often beneficial in securing good coverage and improving adhesion, although on the usual steel surfaces encountered, the adhesion of lead deposited from the fluoborate solution is not a problem.

Sulfate salts should be excluded from the fluoborate bath as their presence will cause precipitation of lead sulfate. If a sulfuric acid pickle is used in the cleaning cycle a double water rinse is recommended before the work is transferred to the lead bath. In areas where the water supply is high in sulfates, the use of a distilled water rinse preceding the plating tank will be found to be helpful in keeping the solution clean. It is advisable to use distilled water to replace evaporation losses.

Fortunately, lead sulfate has a high density and will settle to the bottom of the tank. The clear solution can be decanted from the sludge, the tank cleaned and then the solution returned to the tank. Stainless steel filters have been found serviceable where this method of clarification is convenient.

Health Aspects

Aside from the equipment required and the time consumed in preparing lead plating solution from the basic chemicals, there are health hazards involved in handling concentrated hydrofluoric acid and dry lead salts. Because of this, many manufacturers prefer to purchase prepared lead solutions in concentrated form which are simply diluted with water to form a working solution. There are several excellent concentrates available. Some of these concentrates are sold for specific uses, for example, engine bearing plating.

As lead solutions have been used to such a limited extent in the past, many manufacturers and platers have little or no knowledge of the health hazards involved during the plating operations or in the use of lead plated articles.

There is no absorption of lead salts through unbroken skin. The absorption of lead or lead salts through the alimentary or intestinal tract is very slight but as lead is a cumulative poison, precautions should be taken to prevent the possibility of lead salts being swallowed.

The Food and Drug Administration, Washington, D. C., states[10]:

"The Food, Drug, and Cosmetic Act contains a provision [Section 402(a)(6)] that a food shall be deemed to be adulterated 'if its container is composed, in whole or in part, of any poisonous or deleterious substance which may render the contents injurious to health.' There is no specific provision in the law with respect to lead, but experience has shown that where food is in direct contact with lead, a certain amount of absorption is almost certain to occur in time, and that under some conditions the amount of lead taken up may render such food dangerous to health.

"The storage of food in lead-lined containers or cooking food in such containers may result in the taking up by food of dangerous amounts of lead. This has been definitely shown in the case of maple syrup when evaporators coated with terne plate have been used in its preparation."

In general, the same recommendations that have been made regarding cadmium coatings in respect to their use around foodstuffs[11] should be followed.

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1. Proc. A.S.T.M., **39**, 247 (1939).
2. Blum & coworkers, Trans. Electrochem. Soc., **36**, 243 (1919).
3. "Modern Electroplating," Electrochem. Soc., p. 227 (1942).
4. Gustaf Soderberg, "Electrodeposited Lead Coatings on Steel." Presented at Baltimore-Washington Branch, A. E. S.
5. Wm. Blum and H. E. Haring, Trans. Electrochem. Soc., **40**, 287 1921).
6. Wm. Blum, F. J. Liscomb, Z. Jencks and W. E. Bailey, Trans. Electrochem. Soc., **36**, 243 (1919).
7. Blum and Hogaboom, "Principles of Electroplating & Electroforming," 2nd Ed. (1930).
8. "Modern Electroplating," Electrochem. Soc., p. 227 (1942).
9. "Plating & Finishing Guidebook," p. 65 (1942).
10. Private Correspondence.
11. S. Frant & I. Kleeman, "Metal Finishing," **40**, 131 (1942).

Annotated Bibliography of Aluminum Cleaning* a

Prepared by JAY C. HARRIS[1] and ROBERT B. MEARS[2]

(Continued from June *Metal Finishing*)

The preparation of this bibliography was undertaken to provide Section G on Metal Cleaners of Subcommittee II on Specifications of the A.S.T.M. Committee D-12 on Soaps and Other Detergents with information regarding existent specifications and methods for cleaning aluminum. Included is pertinent information dealing with the various types of commercial cleaning methods, means for inhibiting corrosion and descriptions of established laboratory techniques for the evaluation of detergents used for cleaning this metal.

(68) M. Chaussain and H. Fournier, "Chemical Methods of Cleaning Light and Ultra-Light Metals After Corrosion," *Revue de Métallurgie*, Vol. 31, pp. 201-211 (1934); *Journal*, Inst. Metals, Vol. 1, November, 1934, p. 498.

A discussion of acid cleaning.

(69) H. Krause, "Chemical Cleaning of Non-Ferrous Metals," *Maschinenbau*, Vol. 13, pp. 187-189 (1934); *Journal*, Inst. Metals, Vol. 1, p. 631 (1934).

A discussion of cleaning solutions.

(70) Erling Mathiesen and Erling Mikkelson, "Tests on Washing Compounds for use in the Canning Industry," *Tidsskrift for Hermetikindustrie* (Norwegian Canners' Export Journal), Vol. 20, pp. 185-192 (1934); *Journal*, Inst. Metals, Vol. 2, p. 633 (1935).

For general use a mixture comprising essentially sodium carbonate and water glass with a little soap is most effective for tin plate and sheet aluminum.

(71) H. Schnegg, "Beer Scale on Aluminum Vessels," *Zeitschrift* für das gesamte Brauwesen, Vol. 57, pp. 1-2, 5-10, 13-18, 21-27 (1934); *Journal* Inst. Metals, Vol. 1, May, 1934, p. 270, August, 1934, p. 399.

A comparison was made between several proprietary compounds and nitric acid for the removal of scale from aluminum vessels.

(72) Alfred B. Searle, "Metal Cleaning Preparations," *Chemist and Druggist*, Vol. 121, pp. 462-463 (1934); *Journal*, Inst. Metals, Vol. 2, p. 118 (1935).

Aluminum is best cleaned in soap solution in hot water using a scrubber made of fine metal turnings or a hard brush. Care should be taken not to leave washing soda or substances containing it in contact with aluminum.

(73) Vereinigte Aluminium-Werke, A. G., Research Dept., "Treatment of Aluminum Ware in the Household," *Aluminium*, Vol. 17, pp. 34-36 (1934); *Journal*, Inst. Metals, Vol. 2, January, 1935, p. 32.

Methods are given for cleaning domestic aluminum ware. Various proprietary compositions are recommended.

(74) Chester L. Baker, "Effect of Alkaline Detergents upon Metals," *Industrial and Engineering Chemistry*, Vol. 27, p. 1358 (1935).

Work was restricted to the effect of alkalies upon aluminum, tin plate, copper and zinc at 60°C. ± 2°C. Effects of variables of concentration and immersion time were studied.

Technique.—Series of solutions of each alkali were prepared. 100 ml. of each in tightly stoppered glass bottles was brought to 60 ± 2°C. in a constant-temperature oven. Numbered 0.75 by 2.5 in. strips of virgin aluminum, block tin plate, commercial sheet zinc and electrolytic copper were carefully cleaned, dried and weighed and then immersed for 8 to 24 hr. They were then removed, thoroughly washed with distilled water, then alcohol, dried, and weighed. Since attack occurred immediately with aluminum the study did not establish time-concentration areas within which no attack occurred. In some cases strips carried incrustation so that weight losses do not in every case represent total loss of metal. NaOH, sodium carbonate, attacked immediately and vigorously at all concentrations (0.005 to 10.0 per cent). Trisodium phosphate attacked immediately. Metal was dissolved quantitatively by alkali at all concentrations. Sodium stearate attacked at all concentrations above 0.04 per cent, causing surface blackening. In all cases greasy films of stearic acid were present with this soap and this probably inhibited attack somewhat. Metasilicate in solutions ranging from 0.60 to 5.00 per cent produced no visible attack in 24 hr. At concentrations below 0.60 per cent surface was slightly dulled and at very low concentrations the metal blackened, but the metal lost was small. At concentrations above 5.00 per cent attack increased with concentration and at 10 per cent loss of metal was considerable.

(75) H. J. Barnum, P. S. Lucas and Bruce Hartsuch, "Use of Cleaners in the Dairy Plant," *Special Bulletin No.* 262, Michigan Agricultural Experiment Station, 24 pp. (1935); *Journal*, Inst. Metals, Vol. 3, p. 130 (1936); *Chemical Abstracts*, Vol. 30, p. 1149 (1936).

Cleaners are classified on the basis of comparison, into modified or neutral soda, soda ash, special alkalies, tri-sodium phosphate and colloidal material. Some are highly buffered and others are highly caustic. The emulsifying power is determined with butter fat. Evaluated water softening power. Aluminum, copper and tinned steel were severely scratched by the volcanic ash content of the cleaners. Tinned steel and aluminum were most severely corroded.

(76) H. J. M. Creighton and W. A. Koehler, "Principles and Application of Electrochemistry," Vol. II, pp. 150-151 (1935). John Wiley and Sons, Inc., New York, N. Y.

Cleaning of aluminum in organic solvents may be used. Alkaline cleaners are satisfactory provided that the concentration of the alkali is not sufficient to mar the luster. It is advisable to follow the alkaline cleaning by acid cleaning with 5 per cent hydrofluoric acid solution. The hydrofluoric acid serves the dual purpose of neutralizing any remaining alkali and remedying to a small degree the imperfection in alkaline cleaning.

(77) R. W. Mitchell, "Recent Advances in Metal Cleaning Technology," *Metal Cleaning and Finishing*, Vol. 7, pp. 9-14, 65-68, 133-135 (1935).

Solvents, nascent soaps, and sulfonated cleaners are discussed. Use of phosphates of tin and aluminum formed in the trisodium phosphate cleaning solutions to prevent attack upon the corresponding metals. The use of chromates and silicates for inhibition of alkaline corrosion upon tin and aluminum, though not new, have again been patented.

(78) "Precautions in the Cleaning of Aluminum Tanks with Nitric Acid," *Illustriert Zeitschrift für das Blechindustrie*, Vol. 66, pp. 942-943 (1936). *Journal*, Inst. Metals, Vol. 4, December, 1937, p. 682.

The use of dilute nitric acid for removing the deposit from the walls of aluminum brewing vats, while obviating attack on the metal, may result in the production of nitrous fumes due to oxidation of oxalic acid in the deposit.

(79) "Cleaning Aluminum Equipment in a Brewery," *Light Metals Review*, Vol. 2, February 15, 1936, p. 267.

An abrasive paste was used for cleaning aluminum equipment comprising brewery yeast and ashes taken from the boiler smoke box. The paste is applied to an ordinary wiping cloth and the equipment rubbed vigorously, followed by thorough rinsing with water.

(80) "When Metals Must Be Cleaned," *American Machinist*, European Edition, Vol. 80, No. 42, pp. 871-872 (1936); *Journal*, Inst. Metals, Vol. 4, p. 17 (1937).

Describes various machines and reagents for cleaning metals in their preparation for painting.

(81) F. E. P. Griggs, "Metal Cleaning," *Canadian Chemistry and Metallurgy*, Vol. 20, pp. 258, 260 (1936).

Reprinted from ASTM Bulletin, Jan. and Mar., 1943, by permission of American Soc. for Testing Materials.

* This paper also appears in the A.S.T.M. Standards on Soaps and Other Detergents, p. 107. (Issued as separate publication).

a There are several Armed Forces specifications which are pertinent to this bibliography, but these cannot be abstracted for reasons pertaining to national defense.

1. Chairman, Section G on Metal Cleaners, Subcommittee II on Specifications, Committee D-12 on Soaps and Other Detergents, Monsanto Chemical Co., Dayton, Ohio.

2. Metallurgical Division, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

Removal of (1) rusts and tarnishes, (2) greases and oils, and (3) material adhering to the grease. Outlines requirements for alkaline cleaners: (1) wetting and penetration, (2) colloidal dispersion of soil, and (3) emulsification, saponification, and conductivity. Mentions organic synthetic detergents. Outlines methods for electrolytic cleaning and solvent degreasing.

(82) A. L. Kaye, "Colloidal and Surface Aspects of Metal Cleaning and Finishing," *Metal Cleaning and Finishing*, Vol. 8, pp. 9-12, 40, 71-72, 93-94, 179-182, 311-312 (1936).

Theoretical aspects of metal cleaning.

(83) Maiborada and Korolev, "Chemical Cleaning of Parts Made of Aluminum and Duraluminum in the Airplane Building Industry," *Aeronautical Industry*, No. 8 and 9, pp. 33-34 (1936); *Journal*, Inst. Metals, Vol. 4, December, 1937 p. 682.

The parts to be cleaned are immersed in warm (50 to 60°C.) 5 per cent caustic soda solution containing 1 per cent sodium chloride, for 30 sec., thoroughly washed, immersed in concentrated nitric acid and again washed in water.

(84) W. R. Meyer, C. S. Tompkins, and V. F. Stine, "Cleaning of Metals," *Metals Handbook*, Am. Soc. Metals, pp. 825-841 (1936); *Journal*, Inst. Metals, Vol. 4, p. 556 (1937).

A discussion of metal cleaning.

(85) W. Mohr and Wullhorst, "Experiments with Various Cleaners for Use in Can-Washing Machines," *Molkerei-Zeitung (Hildesheim)*, Vol. 50, pp. 2490-2492, 2525-2528 (1936); *Journal*, Inst. Metals, Vol. 4, p. 148 (1937); *Chemical Abstracts*, Vol. 31, p. 1507 (1937).

The action of two commercial agents and of calcined soda (95 to 100 per cent sodium carbonate) and caustic soda on aluminum, tinned iron and tinned copper, which materials are used in milk transport cans was studied. As in actual practice the temperature was 85 C. and time 12 sec. The concentration of reagents was 0.25 per cent. Soda ash and NaOH are recommended only when silicate is added as a corrosion preventive.

(86) James G. Vail, "Soluble Silicate Cleansers," *Industrial and Engineering Chemistry*, Vol. 28, p. 294 (1936).

Aluminum is sensitive to alkalies in varying degrees according to the acid radical. At 60°C. and 24-hr. exposure, sodium metasilicate is safe up to a concentration of 1 per cent sodium oxide content, whereas the same Na_2O content as caustic, carbonate, or phosphate is harmful. With increasing relative amounts of SiO_2, still higher concentrations of Na_2O become safe. Curves are given to show loss in weight versus Na_2O concentration.

(87) L. Zakarias, "The Displacement of Fats and Oils" (by Fatless Detergents), *Chimie et Industrie*, Vol. 36, pp. 1095-1100 (1936); *Chemical Abstracts*, Vol. 31, p. 3171 (1937). See also *Chemical Abstracts*, Vol. 30, p. 7347 (1936).

Three methods for evaluation of degree of cleaning of metal and other surfaces: (1) repulsion or adhesion of water to surface; (2) acidification and determination of fat; and (3) formation of grease spot on tissue paper. This third method is said to be best. Describes use of fat-free, starch-base cleansing agents for commercial application for which they were tried and found effective, especially for aluminum and aluminum utensils.

(88) C. B. F. Young, "Cleaning of Metallic Surfaces," *The Iron Age*, Vol. 140, October, 1937, pp. 40-43, 185-200.

The absolute necessity for clean base surface is indicated when subsequent coatings are to be applied. Three types of materials to be removed are: (1) Inorganic materials —oxides, sulfides, and basic carbonates; (2) Organic compounds, oils and greases which will saponify, and oils and greases which will not saponify, (3) Mixtures of (1) and (2). Removal of group (1) is accomplished by pickling, but as with brass and copper, a basic cyanide solution may be useful. Use of the electrochemical descaling bath is described. Pickling of tin, zinc, zinc-base die castings and aluminum in 5 to 10 per cent solutions of hydrochloric acid is suggested. Electrolytic cleaning is described. Trisodium phosphate can be used for cleaning zinc-base die castings in either immersion or electrochemical solution. Describes solvent degreasing.

(89) "Degreasing and Cleaning Solutions for Aluminum and Its Alloys," *Light Metals*, Vol. 1, December, 1938, pp. 386-387.

The chemical properties of aluminum are such that special attention must be devoted to the composition of solutions employed in processing it, and to the conditions under which such solutions are used. Several solutions other than the chlorinated hydrocarbons are suggested. These are reviewed, their advantages and disadvantages are pointed out and inhibitors suggested.

(90) J. M. Cosgrove, "The Spot Test as an Aid in the Rapid Evaluation of Cleaners," *Metal Cleaning and Finishing*, Vol. 10, No. 3, p. 186 (1938).

Evaluation of metal cleaners by deposition of a spot of burnt transformer oil upon metal surface and measurement and comparison of elapsed time to remove the spot.

(91) R. W. Mitchell, "Metal Cleaning by Emulsion Degreasing," *Proceedings*, Am. Electrochemical Soc., p. 238 (1938); *Chemical Abstracts*, Vol. 33, p. 5750 (1939).

Emulsion degreasing in two fashions: (1) metal dipped in or sprayed with organic solvent containing an oil-soluble soap or emulsifying agent. Surface given pressure spray rinse which causes emulsification. (2) The solution of oil-soluble soap in organic solvent mixed with kerosene and water to form emulsion. 1 to 3 min. contact with this and then spray rinse. Cost 2 cents per 100 sq. ft. Metals which are to be plated require a treatment with alkaline cleaner after degreasing.

(92) W. Mohr, *et al.*, "Efficiency of Various Detergents and Chemical Sterilizers in the Dairy and Action on Metals and Alloys," *Proceedings*, Eleventh World's Dairy Congress, Berlin, pp. 489-494 (1938); *Journal*, Inst. Metals, Vol. 6, January, 1939, p. 10.

Three types of detergents were studied: (1) sodium hydroxide-sodium carbonate, (2) those containing trisodium phosphate, and (3) those containing organic disinfectants. Solution concentrations of 0.5 to 2.0 per cent of these with small amounts (up to 10 per cent) trisodium phosphate and sodium silicate possessed effective sterilizing action. Proprietary preparation containing sulfonated soaps are effective as 0.1 per cent solutions. The sodium hydroxide-sodium carbonate solutions attacked copper alloys, copper, zinc, and iron slightly even in the presence of the following ions: CrO_4^{--}, PO_4^{---}, and SiO_3^{--}. Aluminum was badly pitted by such solutions.

(93) F. K. Savage, "Alkaline Cleaners and Wetting Agents," *Monthly Review*, Am. Electroplaters' Soc., Vol. 35, pp. 445-450 (1938).

Alkalinity should be closely controlled. Has been found that zinc and aluminum are attacked rapidly above pH of 10; tin above 11; brass above pH 12 to 12.5, depending upon composition; and that iron high in silicon may be pitted above pH 13. Mentions use of wetting agents in cleaners to increase the speed, efficiency and free rinsing characteristics of cleaners without undesirable properties of the soaps. The efficiency of wetting agents is determined by the drop method.

(94) "Cleaning Aluminum Alloy Components Prior to Painting and Enameling," *Light Metals*, Vol. 2, July, 1939, pp. 246-248.

The foreign matter to be removed may consist of one or more of the following: (1) mineral oil blanking lubricant, (2) pure oil of a compounded type used in drilling and tapping, or on automatic screw machines, (3) soap emulsions used in milling, blanking, pressing, etc., (4) heavy soapbase drawing compounds utilized in heavy press work, (5) swarf, and (6) general dust and dirt.

Generally speaking, hand cleaning is effective for the removal of all these forms of contamination; solvent vapor can efficaciously remove (1) and (2), while a combination of solvent liquor and vapor is suitable for (5) and (6). Solvent spray in conjunction with vapor will remove (3) and (4) in restricted circumstances. Alkali solutions are in all cases effective in immersion systems, and, with some reservations, in spray machines. A combination of solvent and alkali processes applied in two stages often affords an economic solution to many problems. Practical notes are presented and laboratory test data are given relating to various types of cleaning agent.

(95) Valborg Aschehoug and Rolv Vesterhus, "Detergents for Aluminum," *Tidsskrift for Hermetikindustri* (Norwegian Canners' Export Journal), Vol. 25, pp. 62-65 (1939); *Food*, Vol. 8, p. 292 (1939); *Journal*, Inst. Metals, Vol. 6, July, 1939, p. 271.

An investigation was made of four solutions regarding their suitability as bactericidal agents in the cleaning of aluminum. A

mixture containing 23.6 per cent sodium carbonate, 22.6 per cent trisodium phosphate, 23.6 per cent sodium silicate and 30.2 per cent water was found to have the strongest bactericidal action in 0.5 to 1.0 per cent solutions at 50°C. in 5 to 10 min. Equally good results were obtained with a mixture containing 15.1 per cent sodium hydroxide, 6.3 per cent sodium carbonate, 26.1 per cent sodium silicate and 52.5 per cent water. Two other detergents tested were inferior.

(96) Bennett (Hyde) Ltd., Degreasing Metals, British Patent No. 516,218, December 28, 1939.

The metal surface is first wetted with a solution of a soap-forming substance, dissolved in a suitable grease solvent, and the thus wetted surface is treated with an aqueous solution of a suitable saponifying agent, preferably in hot condition, to form as a reaction product *in situ* a soap. The surface is then rinsed with water to emulsify and wash away the grease film and the grease solvent.

(97) C. C. Hermann and R. W. Mitchell, "Cleaning of Metals," *The Iron Age*, Vol. 144, July 6, 1939, pp. 48-50.

Aluminum, zinc, and soft metal alloys must be cleaned in alkaline solutions of low pH to avoid corrosion, at a pH value lying between 9 to 10.5. Brass must not be cleaned at a pH over 12.5 to avoid heavy tarnish.

(98) F. Juraschek, "Metal Cleaning and Finishing Economics," *The Iron Age*, Vol. 143, January 26, 1939, pp. 21-28, 48.

There is no sharp line between cleaning and finishing. Gives a guide showing nine separate steps. Under the cleaning step he lists 12 methods: (1) wiping (by hand or machine), (2) brushing (by hand or machine), (3) sand blasting, (4) tumbling, (5) hydraulic spraying, (6) steam gun spraying, (7) dipping in still tank, (8) machine washing, (9) electrolytic cleaning (anodic and cathodic), (10) continuous acid or alkaline dip, (11) vapor degreasing (trichlorethylene), and (12) volatile degreasing (carbon tetrachloride).

(99) R. M. Nepomnyashchaya, "Degreasing Articles Made of Light Alloys," *Novaya Tekhnol. v. Aviastroenii Pervoe Glavnoe Upravlenie NKAP, Kabinet Obmena Opytom po Novoi Tekhnol. i Organizatsii Proizvodstva*, No. 4, pp. 20-23 (1939); *Khim. Referat. Zhur.*, No. 2, p. 88 (1940).

Conditions for degreasing light alloys before anodic polarization are selected. The use of organic solvents is not recommended; they are expensive, poisonous and form a film on the metal not readily washed off. The etching of light alloys in 10 per cent NaOH solution at 60°C., followed by etching in strong HNO_3, does not ensure degreasing. NaOH solution possesses a greater degreasing ability than do its mixtures with phosphates. Nepomnyashchaya recommends 5 per cent $Na_3PO_4.12H_2O$ + 3 per cent Na_2SiO_3 + 1 to 2 per cent NaOH; 50-60°C| 5 min. The proposed method produced a minimum loss of weight of the sample. The effect of the degreasing bath was verified under plant conditions.

(100) F. W. Smither, "Washing, Cleaning, and Polishing Materials," *Circular No. C424*. Nat. Bureau Standards, 63 pp. (1939).

An excellent description of the present-day cleansing agents. Discusses metal polishes and gives formulas, one of which include orthodichlorbenzene as an ingredient. Numerous literature references and Federal specifications are listed.

(101) *Cowles Metal Cleaning Tips*, June, September, November, 1940.

Factors determining the efficiency of metal cleaning products are as follows: (1) alkali action—pH or alkaline activity which determines chemical classification, total alkalinity for neutralization and saponification, detergent pressure which is the combined effect of total alkalinity and pH, (2) colloidal action —colloidal dispersion and peptization action, adsorption of dirt, (3), anion action, (4) conductivity, (5) solvent action, (6) wetting action, (7) emulsifying action, (8) rinsing ability, (9) stability under conditions of use, and (10) safety. Cleaners are classified as follows:

Strongly alkaline—pH 11.6 and above.

Moderately strongly alkaline—alkali of pH 11.0 to 11.5 which are suitable for brass, copper and some of the white metal alloys. Also effective on certain types of dirt on steel and iron.

Moderately alkaline—pH 10.9 to 10.4. These detergents are particularly suitable for cleaning aluminum and washing painted surfaces.

Mildly alkaline—pH 10.3 and below. Detergents have very little use in metal field.

pH measured for classification of alkaline metal cleaners by determination of pH of 0.01*N* solutions on the basis of Na_2O (0.031 per cent Na_2O) at 25 C, that is, determination of per cent total Na_2O and then divide into the factor 3.1 to determine the number of grams per 100 cc. water.

An effective aluminum cleaner should possess the following characteristics: (1) alkaline action should be optimum for the metal, (2) colloidal action is highly desirable, (3) solvent and wetting action on soil should be high, (4) emulsifying action is of prime importance, (5) rinsing ability should be good particularly where metal is subsequently to be anodized, (6) should be safe to the metal and safe to the hands, (7) should possess good solubility; and (8) should be economical.

Conductivity in electrocleaning is important because more rapid gas release takes place at both anode and cathode, causing corresponding increase in the scrubbing action. This current carrying capacity is of greater importance in cleaning steel than with brass and softer metals where demand for vigorous action is less.

(102) "New Aluminum Cleaner," *Metal Finishing*, Vol. 38, August, 1940, p. 446; *Light Metals Bulletin*, Vol. 2, September 5, 1940, p. 204.

A new proprietary aluminum cleaner, "Cowles AE," is described. Is a mildly alkaline cleaner designed to prevent corrosion of non-ferrous metals. Use 3 to 6 oz. per gal. of water. For mirror-finished aluminum surfaces for 1 hr. exposure at the boil, this shows no visible corrosive effect.

(103) "Metal Surface Cleaners," *Product Engineering*, Vol. 11, p. 359 (1940).

Brief methods of cleaning and trade-named preparations for aluminum and aluminum alloys, bronze, copper, zinc, cadmium and zinc-base die castings.

(104) T. K. Cleveland "Solutions for Metal Cleaning," *Monthly Review*, Am. Electroplaters' Soc., Vol. 27, pp. 432-442 (1940); *Chemical Abstracts*, Vol. 34, p. 6731 (1940).

Sodium silicate is recommended for cleaning zinc and aluminum because it attacks these metals to a lesser extent than other alkaline cleaners.

(105) H. G. H. Crowther, "Degreasing of Metal Parts—Use of Aqueous Solutions," *The Metal Industry* (London), Vol. 56, pp. 23-25 (1940).

The principles of the alkaline degreasing of metals are discussed. A successful degreasing solution must be capable of wetting the surface, reducing the interfacial tension between the greasy deposit and H_2O, and emulsifying and deflocculating the deposit. It must also be susceptible of easy removal from the work by rinsing after degreasing is completed.

(106) H. L. Cupples, "A List of Commercially Available Detergents, Wetting, Dispersing and Emulsifying Agents," *Bulletin E-504*, U. S. Dept. of Agriculture, 56 pages, June, 1940.

Over 300 commercial agents are listed with, wherever available, a description of the agent, its chemical composition, and surface properties.

(107) Jay C. Harris, "Chemical Evaluation and Control in Metal Cleaning," *Proceedings*, Am. Electroplaters' Soc., 5 pp. (Preprint) (1940); *Chemical Abstracts*, Vol. 34, p. 7237 (1940).

The necessity for performance tests is emphasized. Titration and pH values are useful for control of acid and alkaline baths. Determination of the amounts of mineral oil or lanolin emulsified by a given concentration of agent in water. Sedimentation tests used as aid in determination of the point where baths are overloaded. Visual tests such as "water break" and swabbing the dried metal surface with tissue paper are useful. Electrolytic cleaning methods suggest the determination of current consumption to obtain unit cleanliness.

(108) H. Schuller, "Cleaning and Degreasing of Metals with Detergents," *Metallwirtschaft*, Vol. 19, November 29, 1940, pp. 1101-1102.

Comparisons are made between inorganic and organic compounds for the cleaning of metals. A new inorganic cleanser known as Henkel P_3 is described. It is claimed that one of its advantages is the cutting down of surface tension.

(109) Verein für Chemische und Metallurgische Production, "Removal of Beer-Scale, Milk-Scale, and Similar Calcareous Deposits from Pasteurizing and Cooling Machines and Piping," German Patent No. 694,237, June 27, 1940.

A dilute solution of tartaric acid, tartrates or a mixture of both, having a pH of 2 to 4 is very effective in removing the scales. To it may be added phosphoric, lactic or citric acid, or their salts. This cleaning solution does not attack metals.

(To be concluded next month)

An Electroplating Library

Compiled by GEORGE B. HOGABOOM, SR.

IN the production of war goods the electrodeposition of metals is of major importance. The protection of iron and steel from corrosion, the increasing of the service life of aluminum by anodizing, and the creation of a long sought bearing metal for high speed motors by duplex plating and diffusion of the deposits are only a few of its applications.

In all the government orders relating directly to the several metals, there are restrictions governing their use in electrodeposition. There is, however, a surprising lack of knowledge about electroplating—how it is done—what comprises its limitations. To many it is a comparatively new process. True, it is only a little over a hundred years old, the first commercial work having been done in 1840. Since that time, however, a number of books have been published, many of which are not known even to some of our leading electroplaters.

The number of bound books on this subject has been generally thought of as very few. The fallacy of this impression is forcefully displayed by the following list.

We have been fortunate in obtaining this list of the books treating directly with *electrometallurgy*, (the term applied to electroplating in the early days), and with *electroplating* as we know it today. These books are part of the library of George B. Hogaboom, Sr., and, as far as we have been able to determine, this is the first time such a list has been compiled for publication.

A few books have probably been omitted from this list and both Mr. Hogaboom and the editors invite those who are in possession of such books to forward their titles, authors and dates of publication. It is hoped that in this way a complete list will be available at some future date.—*The Editors.*

1851 Elements of Metallurgy—*By Alfred Smee*

1853 A Manual of Electro Metallurgy—*By James Napier*

1872 Practical Guide for the Gold and Silver Plater and the Galvanoplastic Operator—*By Alfred Roseleur* (Translated by A. A. Fesquet)

1876 Electro Metallurgy (6th Edition)—*By Alexander Watt*

1883 A Practical Guide for the Gold and Silver Plater and the Galvanoplastic Operator—*By William H. Wahl*

1886 Electro Deposition—*By Alexander Watt*

1891 A Practical Hand-Book of Electroplating—*By Edward Trevert*
The Electroplaters' Handbook (1st Edition)—*By G. E. Bonney*

1894 The Practical Electroplater—*By Martin Brunor*

1897 Modern Electroplating—*By J. H. Van Horne*

1898 Electro-Deposition of Metals (3rd Edition)—*By Dr. George Langbein and William T. Brannt*

1904 Electro Metallurgy (15th Edition)—*By Alexander Watt*
Polishing and Plating of Metals—*By Herbert J. Hawkins*

1905 Electro-Deposition of Metals (5th Edition)—*By Dr. George Langbein and William T. Brannt*
Electro Plating—*By John W. Urquhart*
Electroplaters' Handbook—*By James H. Weston*
Up-To-Date Electroplating—*By James H. Weston*

1906 Manufacture of Metallic Objects—Electrolytically—Electro-Engraving—*By Dr. W. Pfanhauser* (Translated by Joseph W. W. Richards)

1907 Metal Coloring and Bronzing (2nd Edition)—*By Arthur H. Hiorns*

1908 Practical Electroplating—*By W. L. D. Bedell*

1909 Electroplating—*By Paul N. Hasluck*
Electro-Deposition of Metals (6th Edition)—*By Dr. George Langbein and William T. Brannt*

1910 Modern Electroplating—*By J. H. Van Horne*
A Treatise on Electro Metallurgy (3rd Edition)—*By W. G. McMillan* (Revised by W. R. Cooper)

1911 Principles of Electro Deposition—*By Samuel Field*
Electroplating—*By Henry J. Reetz*

1912 Electro Plating—*By William R. Barclay and Cecil H. Hainsworth*

1913 Electro-Deposition of Metals (7th Edition)—*By Dr. George Langbein and William T. Brannt*
Electro Plating and Analysis of Solutions—*By Herman H. Reama*

1917 The Cleaning and Electroplating of Metals—*By Herman H. Reama*

1920 The Modern Electroplater—*By Kenneth M. Coggeshall*
Electro-Deposition of Metals (8th Edition)—*By Dr. George Langbein and William T. Brannt*

1921 Symposium on Electrodeposition and Electroplating—*Transactions, Faraday Society*

1922 Galvanizing and Tinning (2nd Edition)—*By W. T. Flanders*

1923 Practical Electroplating (5th Edition)—*By W. L. D. Bedell*

1925 Principles of Electroplating and Electroforming—*By William Blum and George B. Hogaboom*
The Chemical Coloring of Metals and Allied Processes—*By Samuel Field and Samuel R. Bonney*

1926 Galvanizing — *By Heinz Bablik* (Translated by Charles T. C. Salter)

1930 Electroplating—*By Field and Weill*
Electroplating with Chromium, Copper and Nickel—*By Benjamin Freeman and Frederick G. Hoppe*
Principles of Electroplating and Electroforming (2nd Edition)—*By William Blum and George B. Hogaboom*

1932 Chromium Plating (1st Edition)—*By E. S. Richards*

1934 Practical Handbook on Electroplating (12th Edition)—W. Canning Co.

1935 The Metal Cleaning Handbook—*By Robert W. Mitchell*
Electroplating—*By Field and Weill*
Chromium Plating—*By O. Bauer, H. Arndt and W. Krause* (Translated by E. W. Parker)
Electroplating—*By J. V. Alfriend, Jr.*

1936 Chromium Plating—*By E. S. Richards*
Electroplating—*Popular Science*

1938 Metal Colouring and Finishing (2nd Edition)—*By Hugo Krause*

1940 The Platers' Handbook—*R. Cruickshank, Ltd.*
Anodic Oxidation of Aluminum and Its Alloys—*By Dr. A. Jenny* (Translated by Winifred Lewis)

1942 Modern Electroplating—*The Electrochemical Society*
(No date) The Electroplaters' Handbook (5th Edition)—*By G. E. Bonney*

Foreign Language

1855 Doreur de L'Argenteur et du Galvanoplaste—*By Alfred Roseleur*

1892 Dedicace de la Premier Edition Hydro-Metalloplastic de la Deuxieme Edition—*By Alfred Roseleur*

1914 Galvanizzazione (3rd Edition)—*By Di Frederic Werth*

1922 Metallfärbung—*By Hugo Krause*

1923 Galvanotechnik, Galvanostegie und Galvanoplastik—*By Hugo Krause*
Die Galvanishen Metallneiderschläge und deren Ausführung — *By Herbert Steinach and George Buchner*

1924 Prinzipien der Galvanotechnik—By *Jean Billiter*
Manuel Practique de Dorure, Argenture, Nickelage, Etc.—*By J. Ghersi and P. Conter*

1926 Das Verchromung—Verfähren—*By Dr. W. Pfanhauser*

1931 Nickel Plating (Japanese and English)—*By J. Macdonald Smith*

1933 Simple Treatise on Nickel and Other Plating (2nd Edition) (Japanese and English)—*By J. Macdonald Smith*

1935 Protection des Metaux Contre la Corrosion—*By A. Guerillot*

1937 Metallfärbung—*By Hugo Krause*

BLACKENING STEEL PARTS

A Follow-Through of the Process

By A. P. HILL

E. F. Houghton & Co., Philadelphia, Pa.

THE chemical blackening of steel parts is currently being utilized as a replacement for scarce plating metals, lacquers and paints, or for a corrosion-free surface for later finishes. Offered originally as a substitute, blackening has found a place of its own because of its attractiveness, economy, and utility.

Chemical blackening is appearing in consumers' goods for household and industrial use, and is meeting a favorable reception. It is a useful and important finishing agent for war goods as well.

The finish is *in* and *of* the metal itself. The hard, durable, black oxidation alters the nature of the metal for a few ten-thousandths of an inch as a thin penetration of dense blackness which holds the original dimensions without altering texture or steel characteristics.

Tanks for pre-cleaning, for the blackening bath, and for washing—all of which can be improvised—comprise the installation.

In continuous or interrupted production, the uniform non-reflective, jet-black shade is endlessly reproduced. The blackening bath is composed of activator and regulator, neither of which outpace the other if the temperature is held rigidly at the boiling point. Uniformity of product is inherent in the very simplicity of the process.

There is no pigment to be dried, to break away, to run off, or to melt. The finish is completed in a matter of minutes between bare steel to shipping room or assembly line.

If results should be unsatisfactory, the explanation will lie in the neglect of elementary precautions.

The process begins with clean metal. The steel should be free from oil, since traces of oil would upset the uniform oxidation it is desired to induce. The first step is a dip into a tank of alkaline solution to clean off all oil and dirt.

Rust or scale on the virgin metal would ruin the uniform coat, and metal in that condition is cleaned by pickling. The typical job, however, is free from visible rust and needs only the alkaline bath.

After washing, the alkaline cleaner is removed with plain hot water in the second tank. Next, the metal goes into the blackening bath, the third of the tank battery.

In essence the blackening bath consists of an oxidizing agent and a reducing agent to control its activity. The two reactions are simultaneous. Only black oxide is present at any time, provided the two agents are kept in balance by being held at the boiling point. The speed of the oxidizer varies with temperature, while the speed of the reducer is more nearly constant. If temperature is allowed to fall too low, oxidation will lag and reduction will continue, the result being that little black oxidation will occur and the metal will not color. If the temperature is too high, the oxidizer will outpace the reducer, oxidation will be excessive, and the metal will turn brown.

After the metal has been in the blackening bath for from 5 to 15 minutes, depending on the type of steel, the shape of the part, etc., and the required depth of color is reached, it goes into the fourth tank, which is filled with running cold water. Turbulence and a certain volume of water are needed for removing and bearing off any salt which has adhered to the steel.

The fifth tank is for a hot rinse to complete the cleaning.

The sixth tank is used for a dip in a rust preventive, if the need for greater rust resistance is indicated. If the blackening process is required only as a base for lacquering, the rust-preventive dip is omitted.

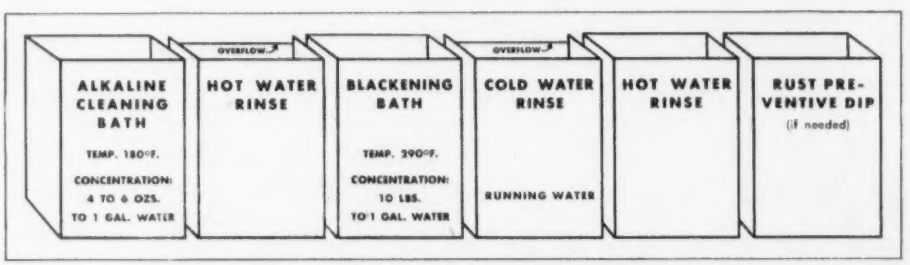
The effective temperature of the blackening bath is the boiling point—295-297°F. An ordinary thermostatic controller (any one of the many offered by manufacturers) serves to hold the blackening bath at the boiling point.

Maintaining the Bath

Water lost from the chemical bath by evaporation is replaced as the level falls, the only precaution necessary is to introduce cold water slowly if the boiling bath becomes too turbulent. If steel pipe is available, a convenient arrangement is to introduce the fresh water below the bath level. Iron pipe cannot be used below the bath level, and is usually installed above and parallel with the top, with one end capped and holes drilled throughout its length.

No iron should be introduced in the chemical blackening tank, which should be of low carbon steel or ordinary boiler plate itself. The blackening bath would spend much of itself in attempting to blacken an iron tank. A steel tank is blackened quickly, and the solution thereafter acts only on the steel in work.

The exhaustion of the blackening solution is indicated by delayed oxidation, and is easily corrected by adding



Typical tank layout for blackening steel.

Note uniform black obtained on parts handled in bulk.

fresh salts. The operator learns to recognize this condition and to correct it by bailing out part of the bath, if necessary, and adding fresh salt.

No special protective clothing is required by the operator, other than the rubber gloves ordinarily used by platers and others handling caustic solutions. Goggles always comprise a safety factor in the use of caustics, but are not in general use by men familiar with lifting work in and out of such solutions.

Now that we have outlined the process, let us follow a job through a typical blackening installation at work.

In this instance, the operator is blackening a batch of steel tubes for electric soldering irons. As there would not be rapid drainage if the tubes were thrown in a basket at random, he tilts the basket slightly and stacks the tubes vertically, being careful not to wedge them in too tightly. When the basket is filled, he lowers the hoist and hooks it into a ring in the handle, then raises the load and sets it down into the cleaner tank—No. 1.

The alkaline cleaner is boiling vigorously, providing agitation which assists in emulsifying the oil and grease and floating them off. After about 10 minutes, the basket is raised and lowered, then transferred to the hot water rinse—No. 2.

The load is again raised and lowered a couple of times to insure adequate rinsing, then is moved into the blackening bath itself—No. 3. After about 10 minutes, the tubes have taken on a deep black color and are transferred to the cold water rinse—No. 4. There the basket of tubes remains for about five minutes, cooling and rinsing.

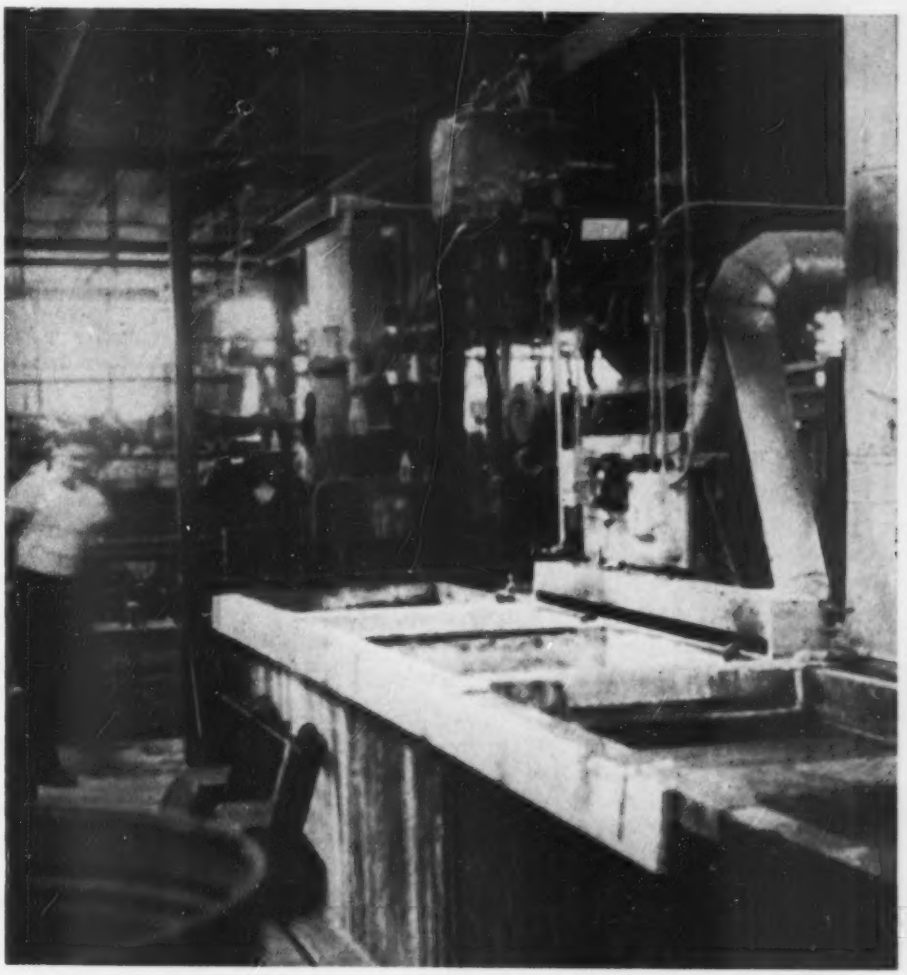
Next, the load is moved to the hot water rinse—No. 5—and allowed to stand for another five minutes. After raising the basket from this rinse and allowing it to drain briefly, the operator lowers it into a rust-preventive oil in No. 6, raises it, and places it on the drainboard. After a period of five minutes, the operator blows off the excess rust preventive from the tubes with compressed air and lowers the basket to the floor, whence it goes to the shipping department.

While waiting for the work to remain in the various tanks for the necessary amount of time, the operator transfers other baskets of work from one tank to the next, so that each tank is in continuous use.

It will have been noted that the baskets were left standing in the alkaline cleaner tank and in the blackening tank for about 10 minutes as against five minutes in the rinse tanks. This was done without disturbing the flow of work by having each of the two first-mentioned tanks twice the size of the remaining tanks, thus allowing two baskets to be immersed at one time as compared with only one basket in the rinse and rust-preventive tanks.

The same type of procedure would be followed with other kinds of work, whether in baskets, on racks, or in movable tumbling barrels.

This example illustrates the kind of work best suited for blackening—items which can be processed in quantity. The large volume of work which can be turned out at low cost is one of the most attractive features of this process, especially where the finishing cost must be kept at the minimum.



Installation for blackening steel in bulk. Note work cylinders leaning against side of tanks, monorail, hoist and exhaust duct.

THIS IS WASHINGTON–

By George W. Grupp
METAL FINISHING's Washington Correspondent

John J. Bognar New Electroplating Finishing Chief John J. Bognar, who is an active member of the Washington-Baltimore Branch of the American Electroplaters' Society and with whom platers may have dealings as Chief of the Finishing and Treating Section of the Repair Shops Division, grew up in the electroplating industry. Since coming to the WPB on June 30, 1942, John J. Bognar has been promoted rapidly. He began as an analyst in the Production Requirements Plan Branch. In September, 1942 he joined the Equipment Service Division as an analyst, and in December, 1942 he became the Senior Industrial Specialist for Electroplaters, Galvanizers and other Metal Coaters in the Repair Shops and General Services Section of the Service Equipment Division. And recently, his chief, Dewey M. Crim, has seen fit to appoint him Chief of the newly created Finishing and Treating Section of the Repair Shops Branch of the Service Equipment Division. For nearly fifteen years before coming to Washington, John J. Bognar was identified with the Chicago plant of the Chromium Corporation of America where he started in the inspection department. Later he worked in the plating, buffing, sales, purchasing, shop production and executive departments. As assistant to the manager of the Chicago plant, he had charge of priorities and purchases. This background has made him a valuable man in the service of the government.

Metal Finishing and PR 11B. Priorities Regulation No. 11B, issued on May 17, 1943, is of importance to the metal finishing industries even though it does not specifically mention them. For this reason, Dewey M. Crim, Chief of the Repair Shops Branch of the Service Equipment Division, got out the letter, part of which follows:

"*Electroplating, Galvanizing, Other Metal Treating and Finishing Industries.*"

"Although the above class of industries have been officially designated as Class 'B' Producers under the Controlled Materials Plan, this is true only when controlled materials are incorporated into the articles being processed. Where controlled materials are used in such production, Form CMP-4B is to be filed if the amounts of such material required are greater than can be readily obtained from warehouses as provided for in CMP Regulation Number 4. The preference rating, or ratings, assigned pursuant to filing Form CMP-4B are to be used in procuring other non-controlled production materials.

"Pursuant to Priorities Regulation Number 11B, Form PD-870, is to be filed for priority assistance in obtaining production materials for those concerns who do not use controlled materials in their production or who use controlled materials in their production, but obtain such controlled materials under CMP Regulation Number 4."

Bills of Materials Instructions The War Production Board has issued a revised edition of the instruction booklet known as "Controlled Materials Plan, Instructions on Bills of Materials." There are no major changes in this new edition for the reason that its chief purpose is merely to clarify and simplify the instructions on the proper preparation of bills of materials. Complete instructions for the filing of both Detailed Bills of Materials and Summary Bills are included in this booklet. It goes into detail on the method of estimating lead time which must be entered on Form CMP-1, Summary Bill of Materials, and for Class B products and items of Government Furnished Equipment on Form CMP-3. It is not necessary to enter lead time for materials on Form CMP-2.

Complete Bills of Materials Procedure According to Direction No. 13 to CMP Regulation No. 1, issued on June 11, 1943, all requests for Complete Bills of Materials must originate with a Claimant Agency. Claimant agencies have been authorized to obtain Complete Bills of Materials for materials required for Class B components, as well as for Class A components. The direction rules that a consumer must not request a Complete Bill of Materials from his suppliers unless he, in turn, has been requested to furnish his customer with a Complete Bill of Materials. The direction also rules that applications for allotments must not include controlled material requirements for the manufacture of Class B components, even though a Complete Bill of Materials has been requested.

Blackplate Sought At a recent meeting of the Crown Manufacturers Industry Advisory Committee, the members told WPB officials that the crown manufacturers are combing the country for blackplate which was frozen in the hands of various manufacturers because of WPB conservation orders. They are also looking for tinmill blackplate rejects and electrolytic waste for the making of crowns.

Cadmium Plating At a recent meeting of the WPB Cadmium Industry Advisory Committee, the members were told that the use of cadmium was steadily increasing. They were told that 90 per cent was used for electroplating and that the remainder was used for bearings, pigments, solders and low-melting alloys. WPB officials explained to the committee that the decrease in actual sales was not due to a decline in use, but the result of the government's desire to have consumers reduce their inventories.

Cadmium Industry Advisory Committee A Cadmium Industry Advisory Committee was recently appointed by the WPB. The members of this committee are Harry J. Wolfe, the Government Presiding Officer; Frank E. Chesney of the American Steel & Wire Co.; F. F. Colcord of the United States Smelting, Refining & Mining Co.; Irwin H. Cornell of St. Joseph Lead Co.; C. A. Dinwoodie of MacDermid, Inc.; Clarence Glass of Anaconda

Copper Mining Co.; O. J. Hall of The Harshaw Chemical Co.; A. E. Mervine of New Jersey Zinc Co.; B. H. Jacob of Eagle-Picher Mining & Smelting Co.; C. H. Klaustermeyer of E. I. du Pont de Nemours & Co.; L. K. Lindhal of The Udylite Corp.; L. G. Matthews of the American Smelting and Refining Co.; Paul M. Savage of The McGean Chemical Co.; Dr. R. R. Shively of B. F. Drakenfeld & Co.; Kurt Weinberg of International Minerals & Metals Corp.; and Charles W. Yerger of Hanson-Van Winkle-Munning Co.

Chlorate Chemicals Allocation Procedure The allocation procedure of chlorate chemicals such as potassium chlorate, sodium chlorate, barium chlorate, potassium perchlorate, ammonium perchlorate, perchloric acid, and any other chlorate or perchlorate chemical, was simplified by General Preference Order M-171 as amended June 7, 1943, for the purpose of eliminating some of the paper work for industry. Form PD-602 is now used by producers and distributors in making application for allocation. The order provides that in the future allocations shall be made on a quarterly instead of a monthly basis. No specific authorization from WPB is required by a supplier for the delivery of 25 pounds or less of any chlorate chemical to a person during a calendar quarter.

Electroplating & Anodizing Equipment Committee During the past month the WPB announced the formation of an Electroplating and Anodizing Equipment Manufacturers Industry Advisory Committee which consists of William W. McCord as Government Presiding Officer; William E. Belke of Belke Mfg. Co.; S. L. Cole of Charles F. L'Hommedieu & Sons, Inc.; B. G. Daw of Lasalco, Inc.; O. W. Hakanson of The Meaker Co.; T. W. Kirby of A. T. Wagner Co.; L. K. Lindhal of The Udylite Corp.; A. J. MacDermid of MacDermid, Inc.; John M. Mayers of Frederick B. Stevens, Inc.; A. P. Munning of Munning & Munning, Inc.; Van Winkle Todd of Hanson-Van Winkle-Munning Co.; and G. A. Spencer of Crown Rheostat & Supply Co.

Electrolytic Tinplate Closures The use of 0.50 electrolytic tinplate instead of hot dipped tinplate for the manufacture of closures was directed by Conservation Order M-104, as amended May 17, 1943. The amended order permits manufacturers to use any "menders" arising in the production of 0.50 electrolytic tinplate which have not been dipped with a maximum tin coating of 1.25 pounds per base box.

Lead Restrictions Eased Lead has been made more readily available as a substitute for more critical materials going into essential production in amending Limitation Order M-38 on May 26, 1943. The amended order has eliminated the 90 per cent limitation on all uses, except for such items as appear in List A of the amended order. Some of the banned items are buttons, badges, emblems and regalia if not for the armed services; costume jewelry, novelties and trophies; caskets and casket hardware; name plates, and seals and labels. This amended order revokes Order M-38-c and the original Order M-38. It also revokes Supplementary Orders M-38-a and b, and M-38-d to i.

Order M-43-a Revoked With the issuance of Conservation Order M-43, as amended May 25, 1943, Order M-43-a was revoked. The amended order makes it now permissible to use pure tin coatings on all copper wire 0.0320" nominal diameter and finer and a 12 per cent tin alloy coating on thicker copper wire where the coatings are required to meet performance specifications. The amended order permits the use of tin and tin alloys for coating steel wire under certain conditions. It also permits the use of tin for tinning and retinning equipment used in the preparation of food by institutions and industrial and commercial establishments. Lead alloy containing not more than 2½ per cent tin derived from secondary sources for corrosion resisting purposes may now be used. *This permission was granted to facilitate the substitution of lead coatings for galvanizing.*

Repair Shops Branch Created The Repair Shops and General Services Section of the Service Equipment Division of the WPB has been reorganized. The section is now known as the Repair Shops Branch. This branch has been divided into two sections. Dewey M. Crim, formerly Chief of the Repair Shops and General Services Section is Chief of the new branch. C. B. Griffith, who was formerly Deputy Chief of the old section is Deputy Chief of the new branch, and Chief of the Electrical and Mechanical Section of the branch. John J. Bognar, who was the old section's senior industrial specialist for electroplaters, galvanizers and other metal coaters, has been promoted to Chief of the newly created Finishing and Treating Section of the Repair Shops Division.

Repair Work Charges The Office of Price Administration announced on May 20, 1943 that if a customer requests special service to do repair work in overtime hours and the work is actually done during overtime hours by mechanics who are paid time and one half, the appliance repair shop is permitted under such conditions to charge one and one half times its regular customers' hourly rate. This special charge cannot be made where the repair shop regularly worked overtime in March, 1942, without making any distinction in its charges for regular and overtime hours. In all cases, however, overtime work at an extra charge must be specially authorized by the customer. The extra charge cannot be made merely because employees worked overtime to finish the job which the customer intended should be completed during regular shop hours. This announcement should be of particular interest to job and contract platers and finishers.

Saving of Tin The War Production Board has estimated that 3,000 tons of tin will be saved in 1943 and that 5,000 tons will be saved in 1944 by the use of silver-lead solder instead of tin-lead solder in sealing cans for chemicals and other commodities. The silver-lead solder contains approximately 2.5 per cent of silver, 93.5 per cent of lead and 5 per cent of tin. On the other hand, the tin-lead solder contains from 30 to 40 per cent of tin and from 60 to 70 per cent of lead.

Silver Usage Survey Fifty Federal Trade Commission examiners, acting for the WPB, will make a survey of 217 companies to determine their degree of compliance with war-time regulations on the use of silver. This survey is being made especially to enforce Silver Conservation Order M-199. This order restricts the use of foreign silver in the manufacture of certain goods, *including silverware*, except to fill war orders. It limits the use of domestic silver to fifty per cent of a base period figure for non-war commodities. With slight variations depending upon the form, the ceiling price for foreign silver is 45 cents per fine Troy ounce and, for domestic silver, 71 cents.

Spectacle Metal Order Schedule 2 of General Limitation Order L-214, issued on May 20, 1943, prohibits the use of any metal in corrective spectacles except specified kinds of metals. For example, *it is permissible to use nickel, gold, palladium, and rhodium for plating "white metal" spectacle ware.* Nickel silver (containing not more than 10 per cent nickel in the alloy), or copper-base alloy, may be used in end pieces, guard arms, pad inserts, and temples. Nickel silver with 18 per cent nickel may be used in screws and dowels.

Zinc Order Amended Conservation Order M-11, as amended June 7, 1943, clears up an ambiguity about the buying of zinc. This amended order states that "any person may ship, sell and deliver zinc, remelt zinc or zinc scrap to the Metals Reserve Company, without an allocation certificate, preference rating or any specific authority from the War Production Board, provided, however, that such material is purchased for the sole purpose of stockpiling or distribution." It also provides that only the Metals Reserve Company is now permitted to buy for public account.

POSSIBLE SUBSTITUTES FOR METAL FINISHING MATERIALS

The Conservation Division of the WPB has sought and is still seeking possible substitutes to meet the demand for critical materials. Based on its findings and records, the first installment of a compilation of materials, their restricting conservation order numbers and possible metal finishing substitutes according to Product Groups was presented in the June issue; the second and concluding part appears below.

Product Group	*Restricting Conservation Order Number*	*Material*	*Possible Substitutes*
Notions, Novelties	M-65	Cadmium	Black Japan
"	M-38	Lead	Cellulose Acetate
"	M-6	Nickel	Paint; Enamel
Office & Artists' Materials	M-65	Cadmium	Palladium in pen points
"	M-56	Natural Resins	Aniline Dyes; Stains; Oleoresinous Varnish
"	M-6	Nickel	Paint; Enamel Baked Organic Finish
"	M-199	Foreign Silver	Domestic Silver
"	M-43	Tin	Painted or Enameled Steel
Office Machinery	M-6	Nickel	Paint; Enamel
"	M-11	Zinc	Organic Coatings
Optical Goods	M-39	Cobalt	Enamel; Lacquer
"	M-11	Zinc	Organic Coating
Paints & Varnishes	M-1	Aluminum	Lead, Ground or Flake Mica; Grey Pigments
"	M-184	Aniline	Inorganic Pigments
"	M-112	Antimony	Zirconia
"	M-150	Aromatic Petroleum Solvents	Xylol Petroleum Ether; Light Petroleum Solvents; Light Chlorinated Solvents; Certain Alcohols, Ethers, Esters, & Ketones; Blends of the above with Petroleum Naphthas; Rubber Solvents; Aliphatic Petroleum
"	M-137	Benzene	Same as Aromatic Petroleum Solvents except Aliphatic Petroleum
"	M-159	Butyl Alcohol	Amyl Alcohols; Propyl Alcohols; Ethylene Glycols; Monoethyl Ethers; Methyl Pentanethol, Tetrahydrofurfural Alcohol; Esters; Fusel oil
"	M-167	Capryl Alcohol	2 Ethyl Butyl Alcohols; Sexhexyl Alcohols; Isophorone Cyclohexanol
"	M-18	Chromium	Ochre; Siennas
"	M-103	Dyestuffs	Vegetable Dyes
"	M-175	Ethyl Cellulose	Limed Rosins; Cellulose Acetate; Alkyds
"	M-78	Mercury	Copper Compounds
"	M-169	Methyl Ethyl Ketone	Acetone; Isopropyl Ether; Ethyl Acetate plus Isopropyl Acetate
"	M-142	Naphthenic Acid & Naphthenates	Linoleates; Resonates; Tallow derivatives
"	M-56	Natural Resins	Alkyds; Rosins; Ester Gum; Hardened Rosin; Asphalt; Pitches
"	M-196	Nitrocellulose, soluble	Coumarine Resins; Asphalt; Oleoresinous Coatings
"	M-183	Phosphate Plasticizers	Castor oil
"	M-203	Phthalate Plasticizers	Castor oil; Monoglycols; Glycol Hexaricindeate
"	M-15	Rubber	Bituminous Asphalt
"	M-46	Rubber Chlorated	Alkyd Resins
"	M-106	Shellac	Alkyds; Casein; Ester Gum; Limed Resin
"	M-104	Tin tops for glass containers	Black-plate; Wood; Glass; Plastics
"	M-34	Toluene	Same as Aromatic Petroleum Solvents in this product group except Aliphatic Petroleum
"	M-57	Tung Oil	Resins; Modified Fish, Linseed and Soy Bean Oils; Re-esterified Oils; Dehydrated Castor Oil
"	M-29	Tungsten	Chromates
"	M-128	Zinc Sulfide Pigments	Titanium Dioxide
Photographic Equipment	M-126	Iron & Steel	Paint; Enamel
"	M-15	Rubber	Porcelain Enamel; Cellulose Acetate
"	M-11	Zinc	Paint; Enamel Coatings
Pipes, Valves, Fittings	M-1	Aluminum	Iron & Steel with Coatings
"	M-65	Cadmium	High-lead Solder Dip; Baked Non-metallic Protective Enamel
"	M-11	Zinc	Organic Coatings
Portable Power Tools	M-6	Nickel	Paint; Enamel
"	M-11	Zinc	Organic Coatings
Pumps, Compressors, Fans	M-6	Nickel	Paint; Enamel
"	M-68	Oil Industry Production Material	Silver, Chromium, Zinc or Bonderized Coatings; Paint
"	M-11	Zinc	Organic Coatings
Radio & Phonograph Equipment	M-1	Aluminum	Brass; Zinc
"	M-65	Cadmium	Black Japan; Galvanize
"	M-9	Copper	Domestic Silver
"	M-11	Zinc	Organic Coatings

Product Group	*Restricting Conservation Order Number*	*Material*	*Possible Substitutes*
Locomotives, Cars, etc.	M-9	Copper	Bands—Zinc Plated Steel; Weather Stripping—Zinc Plated Steel; Insulation—Zinc Plated Steel; Water Containers—Enameled Steel
"	M-56	Natural Resins	Oil Paints; Limed Rosin
"	M-6	Nickel	Paint
"	M-11	Zinc	Organic Coatings
Refrigerating & Air Conditioning Equipment	M-1	Aluminum	Brass; Porcelain Enamel for trays
"	M-65	Cadmium	Galvanized Dip Coating for food storage; High-Lead Solder for other uses
"	M-126	Iron & Steel	Porcelain Enamel for ice cube trays
"	M-43	Tin	Galvanized (hot-dip) Coating; Chip-proof Porcelain
Saddlery, Harness, etc.	M-65	Cadmium	Zinc Coating; Paint; Enamel
"	M-18	Chromium	Paint; Enamel
"	M-9	Copper	Domestic Silver
"	M-126	Iron & Steel	Domestic Silver
"	M-6	Nickel	Paint; Enamel
"	M-43	Tin	Enamel; Paint
"	M-11	Zinc	Organic Coatings
Safety Equipment	M-6	Nickel	Silver, Chromium, Zinc or Bonderized Coatings; Paint
"	M-43	Tin	Zinc; Silver; Chrominm; Terneplate; Paint
"	M-11	Zinc	Organic Coatings
Sanitary Ware	M-1	Aluminum	Painted Steel for trimmings
"	M-38	Lead	Waterproofing Compounds; Galvanized Steel
"	M-11	Zinc	Organic Coatings
Scientific Instruments, etc.	M-21	Steel	Zinc Coated, Enameled or Bonderized Steel
"	M-29	Tungsten	Hard Chromium Plating
"	M-11	Zinc	Organic Coatings
Ships & Boats	M-9	Copper	Coated Iron and Steel; Galvanized Ware
"	M-6	Nickel	Zinc Coatings; Paint; Enamel
"	M-11	Zinc	Organic Coatings
Movers	M-11	Zinc	Organic Coatings
Stoves & Ranges	M-65	Cadmium	Non-metallic Paints
"	M-9	Copper	Coated or Uncoated Ferrous Metal
"	M-6	Nickel	Porcelain Enamel
Street Cars	M-9	Copper	Zinc Plated Steel for stripping and insulation
"	M-6	Nickel	Paint; Enamel
"	M-11	Zinc	Organic Coatings
Surgical, Dental Goods	M-11	Zinc	Organic Coatings
Telephone & Other Electrical Communications, Except Radio	M-65	Cadmium	Galvanized Zinc; Lead Coating
"	M-11	Zinc	Organic Coatings
Toys, Sporting Goods	M-25	Formaldehyde	Galvanized Ware
"	M-6	Nickel	Paint; Enamel
Tractors	M-9	Copper	Powdered Bronze for bushings and bearings; Powdered Iron for bushings; Enamel for trim parts
"	M-11	Zinc	Organic Coatings
Trailers	M-9	Copper	Plated Steel
"	M-6	Nickel	Paint; Enamel; Zinc Plating
"	M-15	Rubber	Enamel
Trucks & Cars	M-65	Cadmium	Plated Steel; Zinc Plating; Paint; Enamel
"	M-66	Cashew Nut Shell Oil	Phenols; Cresols
"	M-9	Copper	Steel-Zinc Plate
"	M-6	Nickel	Paint; Enamel; Zinc Plating
Umbrellas	M-11	Zinc	Organic Coatings
Vehicles, Animal Drawn & Miscellaneous	M-9	Copper	Zinc Plating; Enameled Steel
"	M-6	Nickel	Zinc Plating; Paints; Organic Finishes; Enamel to replace plating of parts
"	M-11	Zinc	Paints; Organic Finishes; Enamel
Vending Machines	M-65	Cadmium	Black Japan
"	M-11	Zinc	Organic Coatings
Window & Door Screens & Shades	M-1	Aluminum	Galvanized Steel
"	M-65	Cadmium	Paint
"	M-9	Copper	Galvanized Steel
"	M-11	Zinc	Galvanized Steel
Wire & Cable	M-15	Rubber	Varnished Cambric
"	M-11	Zinc	Organic Coatings

SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Rochelle Salts Solution Plates Rough

Question: About six months ago we changed from a cyanide copper solution to a Rochelle salts solution and had very good results from it up until a few weeks ago when it began to plate rough. The pH was high so I lowered it to about 12.2 but that did not seem to help. The solution looks as though it is riled up. We work the bath at a temperature of 130°F. and use a current density of about 60-80 amp./sq. ft. with no agitation. I have analyzed the solution and it seems to be within the approximate limits as prescribed.

Answer: Since, according to your letter, the usual ingredients are present in satisfactory concentrations, the probability is that the roughness you are experiencing with your plate is due either to contamination or to improper anode corrosion.

If you are using hypo as a brightener, there may be the possibility that the decomposition products result in roughness. This very often happens when an excess of the brightener is present.

You may get some relief by treating the solution with activated carbon.

A current density of 60-80 amp./ sq. ft. is considered quite high when no agitation is used. To relieve the condition, we suggest that you try operating the solution at a higher temperature such as 140-150°F. and a lower current density, if necessary.

"Cronak Finish"

Question: What is "Cronak Finish," how is it applied, what is its appearance? To obtain the chemicals for this finish, must one have a priority rating?—S. P. W.

Answer: "Cronak Finish" is produced on zinc by immersion for 10-30 seconds in a solution of approximately two pounds of sodium dichromate per gallon acidified with sulfuric acid. The coating is iridescent with a brassy colored tint.

We do not believe that a priority will be required for the chemicals. However, you can check this with your local branch of the War Production Board.

The process is patented and further details may be obtained from The New Jersey Zinc Co., 160 Front St., New York, N. Y., who own the patent. The process is offered royalty free for war work.

Plating Inside Small Tubes

Question: We are having difficulty electroplating steel tubes with copper. Their length is about 12 inches but their diameter is only ¼ of an inch. Plating must be done inside the tubes. When we receive the tubes they are already plated with copper, probably cyanide, on the outside. If it were possible for us to plate the inside of the tubes, we might be able to do the whole job. I do not know of any solution which would have sufficient throwing power to deposit any kind of metal on the inside of tubes of such small diameter. It would be a troublesome job to put auxiliary anodes of wire inside the tubing inasmuch as we have hundreds of them to plate.—V. D. N.

Answer: In a tube 12 inches in length and only one-quarter of an inch in diameter, it will not be possible to electroplate the inside with copper unless you use an auxiliary anode since the throwing power of no copper solution would be high enough to put an appreciable amount of copper on the inside.

Treatment of Chromic Acid Sores

Question: Is there any treatment, either preventive or curative, which will help chromic acid sores? This information is vital to us because the men can't work with chrome sores on their hands. We have tried various emollients and greases but the chrome seems to cut through them easily. Naturally, we use rubber gloves, but the fumes drift in somehow and we can't stop the gloves from being torn by the work. If you know of anything which may help us, please let us know immediately.—S. P. Co.

Answer: There are various ointments on the market which are helpful but a good part of the trouble with chromium sores is caused by the dampness and perspiration which result from wearing rubber gloves. We suggest that talcum powder be used at frequent intervals and that the gloves be aired out and dried often. After the day's work, the hands should be washed thoroughly with soap and water and after drying, ointment should be applied immediately.

Removal of Excess H_2SO_4 from Cr Bath

Question: By accident some one added too much sulfate to our chromium plating solution. It is my belief that by adding a salt to the solution to reduce the sulfuric acid, another acid would be formed. Please advise if you know of any way to remove the sulfuric acid.—J. J. V.

Answer: To remove excess sulfate you should add two ounces of barium carbonate for each ounce of sulfuric acid to be removed. This will precipitate the sulfate as barium sulfate and at the same time will neutralize the acidity now present. The reaction is as follows:

$$H_2SO_4 + BaCO_3 \rightarrow BaSO_4\downarrow + H_2O + CO_2$$

You will note from the chemical action that water and carbon dioxide gas are the end production in addition to the barium sulfate precipitate.

Glass Etching and Frosting

Question: In your February or March issue you published a glass etching and frosting formula. We occasionally etch figures on glass parts, but have always used the pure hydrofluoric acid.

Can you tell us what difference in results we might get by using the formula you recommend instead of pure acid? Naturally, there is considerably more effort involved in securing, stocking and mixing the various ingredients as compared to using a material as purchased.—W. & T. Co., Inc.

Answer: The purpose of the formula recommended is to put a matte or frosted finish on glass not obtainable with pure hydrofluoric acid. The latter generally will etch the glass but will leave it clear.

Data on Hot Tinning

Question: I am foreman of an electroplating department of which molten hot tinning (40% tin, 60% lead) is a part. We are having considerable difficulty in obtaining a standard, stain-free, smooth finish. I am seeking information concerning flux, palm oil, manner of eliminating rough deposit and after treatment rinses. If you cannot supply direct information, sources of such information would be helpful.—E. A. F.

Answer: We suggest that you communicate with the following: Tin Research Institute, c/o Battelle Memorial Institute, 505 King Ave., Columbus, O. and Lead Industries Association, 420 Lexington Ave., New York, N. Y. Both these associations will be pleased to supply you with the information you are seeking.

Dictionary of Metal Finishing Chemicals

Copper Monochloride: See Cuprous Chloride.

Copper Monoxide: See Cupric Oxide.

Copper Nitrate: $Cu(NO_3)_2 \cdot 3H_2O$. Mol. wt. 241.63. Sp. gr. 2.05. M. P. 114.5°C. Blue, deliquescent crystals. Also known as Cupric Nitrate. Solubility, 138 at 0°C. and 1270 at 100°C. Soluble in alcohol. Grades: Technical, Purified, C. P., 54°Be. solution. Containers: Bottles (1, 5 lb.); Crocks (25, 50 lb.); Kegs (100 lb.); Barrels (750 lb.).

Copper Oxalate: $CuC_2O_4 \cdot \frac{1}{2}H_2O$. Mol. wt. 160.60. Blue-white powder. Also known as Cupric Oxalate. Insoluble in water. Soluble in ammonia. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.).

Copper Oxide, Black: See Cupric Oxide.

Copper Oxide, Red: See Cuprous Oxide.

Copper Protoxide: See Cuprous Oxide.

Copper Scale: A mixture of cupric and cuprous oxides, formed on copper surfaces upon heating.

Copper Subacetate: See Copper Acetate, Basic.

Copper Suboxide: See Cuprous Oxide.

Copper Sulfate: $CuSO_4 \cdot 5H_2O$. Mol. wt. 249.71. Sp. gr. 2.285. Triclinic, blue, large or small crystals, granules or powder. Also known as Cupric Sulfate, Blue Vitriol, Bluestone, Blue Copperas. Loses water of crystallization when heated. Solubility, 31.6 at 0°C. and 203 at 100°C. Soluble in methyl alcohol. Grades: Technical, U. S. P., C. P. Containers: Bottles (1, 5 lb.); Cartons (1, 5, 25, 50 lb.); Boxes (25, 50 lb.); Kegs (25, 50, 100, 125 lb.); Drums (100 lb.); Barrels (250, 300, 350, 450, 500 lb.).

Copper Sulfate, Anhydrous: $CuSO_4$. Mol. wt. 159.63. Sp. gr. 3.61. M. P. 200°C. Greenish white crystals. Solubility, 14 at 0°C. and 75 at 100°C. Slightly soluble in methyl alcohol. Grades: Technical, Purified, C. P. Containers: Bottles (1, 5 lb.); Drums (100 lb.); Barrels (300 lb.).

Copper Sulfide: CuS. Mol. wt. 95.63. Sp. gr. 4.2. M. P. 1100°C. Hexagonal or monoclinic grey-black crystals, powder. Also known as Cupric Sulfide. Insoluble in water. Soluble in nitric acid, cyanide solution, hot, concentrated hydrochloric acid and sulfuric acid. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Barrels.

By clipping these sheets from the monthly issues of *Metal Finishing*, when this series has run its course, you will have a complete dictionary of chemicals relative to the electroplating industry. The terms Abel's Reagent-Copper Hydroxide appeared in the January-June issues.

Copperas: See Ferrous Sulfate.

Copperas, Blue: See Copper Sulfate.

Copperas, Green: See Ferrous Sulfate.

Copperas, White: See Zinc Sulfate.

Corrosive Sublimate: See Mercuric Chloride.

Corundum: Natural form of Aluminum Oxide, q. v.

Cream of Tartar: See Potassium Bitartrate.

Cresol, Meta: $CH_3C_6H_4OH$. Mol. wt. 108.134. Sp. gr. 1.034. M. P. 10.9°C. B. P. 202.8°C. Colorless liquid with phenolic odor. Also known as Metamethyl Phenol, Metahydroxytoluene, Cresylic Acid, Metacresylic Acid. Solubility, 2.4 at 20°C. and 5.8 at 100°C. Infinitely soluble in alcohol and ether. Soluble in organic solvents and chloroform. Grades: Technical. Containers: Bottles (1, 5 lb.); Cans (5, 10, 25, 40 lb.); Carboys (100 lb.); Barrels (400 lb.); Drums (450, 850 lb.); Tank Cars.

Cresol, Ortho: $CH_3C_6H_4OH$. Mol. wt. 108.134. Sp. gr. 1.047. M. P. 30°C. B. P. 191.5°C. Colorless crystals or liquid with phenolic odor. Also known as Orthomethyl Phenol, Orthohydroxytoluene, Orthocresylic Acid, Cresyl Alcohol. Solubility, 3.1 at 40°C. and 5.6 at 100°C. Infinitely soluble in ether and alcohol above 30°C. Soluble in chloroform and organic solvents. Grades: Technical. Containers: Bottles (1, 5 lb.); Cans (5, 10, 25, 40 lb.); Carboys (100 lb.); Barrels (400 lb.); Drums (450, 850 lb.); Tank Cars.

Cresol, Para: $CH_3C_6H_4OH$. Mol. wt. 108.134. Sp. gr. 1.035. M. P. 36°C. B. P. 202.5°C. Colorless, prismatic crystals. Also known as Paramethyl Phenol, Parahydroxytoluene, Paracresylic Acid. Solubility, 2.4 at 40°C. and 5.3 at 100°C. Infinitely soluble in ether and alcohol above 36°C. Soluble in organic solvents. Grades: Technical. Containers: Bottles (1, 5 lb.); Cans (5, 10, 25, 40 lb.); Carboys (100 lb.); Barrels (400 lb.); Drums (450, 850 lb.); Tank Cars.

Cresol, U. S. P.: Mixture of Ortho, Meta and Paracresols boiling between 190 and 210°C. Containers: Bottles (1, 5 lb.).

Cresyl Alcohol: See Cresol, Ortho.

Cresylic Acid: See Cresol, Meta.

Cresylic Acid, Meta: See Cresol, Meta.

Cresylic Acid, Ortho: See Cresol, Ortho.

Cresylic Acid, Para: See Cresol, Para.

Crocus: See Ferric Oxide, Red.

Crocus Martis Adstringens: See Ferric Oxide, Red.

Crocus, Polishing: See Ferric Oxide, Red.

Crude Oil: See Petroleum.

Crystal Ammonia: See Ammonium Carbonate.

Crystal Carbonate: See Sodium Carbonate Monohydrate.

Cupric Acetate: See Copper Acetate.

Cupric Acetate, Basic: See Copper Acetate, Basic.

Cupric Ammonium Chloride: See Copper Ammonium Chloride.

Cupric Ammonium Sulfate: See Copper Ammonium Sulfate.

Cupric Carbonate: See Copper Carbonate.

Cupric Carbonate, Basic: See Copper Carbonate, Basic.

Cupric Chloride: See Copper Chloride

Cupric Hydroxide: See Copper Hydroxide.

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Cupric Monoxide: See Cupric Oxide.

Cupric Nitrate: See Copper Nitrate.

Cupric Oxalate: See Copper Oxalate.

Cupric Oxide: CuO. Mol. wt. 79.57. Sp. gr. 6.4. M. P. 1064°C. Brown black or black, fine crystals or amorphous powder. Insoluble in water. Soluble in acids, cyanide solutions and ammonium chloride solutions. Grades: Technical, Purified, C. P., powder, wire, granular. Containers: Bottles; Cans (1, 5 lb.); Boxes; Tins (25 lb.); Kegs (100 lb.); Barrels (500, 700 and 1,000 lb.).

Cupric Subacetate: See Copper Acetate, Basic.

Cupric Sulfate: See Copper Sulfate.

Cupric Sulfide: See Copper Sulfide.

Cuprous Chloride: CuCl. Mol. wt. 99.03. Sp. gr. 3.5. M. P. 422°C. Cubic white crystals or powder. Also known as Copper Monochloride. Insoluble in water. Soluble in hydrochloric acid and ammonia. Grades: Technical, C. P. Containers: Bottles (1, 5 lb.); Tins (1, 5, 25 lb.); Crocks (25 lb.); Kegs (100 lb.); Barrels (300 lb.).

Cuprous Cyanide: See Copper Cyanide.

Cuprous Oxide: Cu_2O. Mol. wt. 143.14. Sp. gr. 6.0. M. P. 1235°C. Reddish brown, cubic, crystalline scales and powder. Also known as Red Copper Oxide, Copper Protoxide, Copper Hemioxide, Copper Suboxide. Soluble in hydrochloric acid, ammonium chloride solutions and ammonia. Slightly soluble in nitric acid. Insoluble in water. Grades: Technical, C. P. Containers: Bottles, Cans (1, 5 lb.); Boxes, Tins (25 lb.); Drums, Kegs (100 lb.); Barrels (500, 1,000 lb.); Casks (1,150 lb.).

Cyanide: See Sodium Cyanide.

Cyanogen: C_2N_2. Mol. wt. 52.04. M. P. —34°C. Colorless, poisonous gas with penetrating odor. Also known as Carbon Nitride. Slightly soluble in water. Grades: Technical, Purified. Containers: Liquid in cylinders.

Damar Gum: See Dammar Gum.

Damar Resin: See Dammar Gum.

Dammar Gum: Sp. gr. 1.04-1.12. M. P. 120°C. Yellowish white, semi-translucent, friable mass. Also known as Damar Gum, Damar Resin. Soluble in organic solvents. Grades: Technical, chips, dust, seeds. Containers: Cartons (1, 5, 10, 25 lb.); Cases (160 lb.); Bags.

Degras: Dark brown fat with disagreeable odor. Also known as Wool Grease. Soluble in alcohol, ether and benzene. Grades: Technical. Containers: Barrels.

Denatured Alcohol: Ethel Alcohol (q. v.) to which substances have been added which make it unsuitable for beverage purposes. Also known as Methylated Spirits.

Dextrin: Yellowish to white powder or granules. Also known as British Gum, Starch Gum, Artificial Gum, Vegetable Gum. Soluble in water. Insoluble in alcohol. Grades: Technical, yellow and white; N. F. corn, potato, alcohol precipitated, C. P. Containers: Bottles (1, 5 lb.); Cans, Cartons (1, 5, 10, 25, 50 lb.); Drums, Kegs (100 lb.); Bags (140, 200 lb.); Barrels (220, 250, 300 lb.).

Dextrose: $C_6H_{12}O_6 \cdot H_2O$. Mol. wt. 198.17. White crystals or granules, anhydrous powder and syrup. Also known as Grape Sugar, Glucose, Corn Sugar. Soluble in water. Grades: Technical, U. S. P., C. P. Containers: Bottles, Cartons, Tins (1, 5 lb.); Cans, Kegs (25 lb.); Bags (100 lb.); Barrels (400 lb.); Slabs, Tank Cars.

Diatomaceous Earth: Soft, porous rock composed of skeletons of small plants called diatoms. Also known as Kieselguhr, Infusorial Earth. Consists mainly of silica. Grades: Technical, U. S. P. Containers: Bags (1, 10, 50 lb.); Bulk.

Digallic Acid: See Tannic Acid.

Dimethylbenzene: See Xylene.

Dimethyl Carbinol: See Isopropyl Alcohol.

Dimethylglyoxime: $(CH_3)_2C_2(NOH)_2$. Mol. wt. 116.12. M. P. 234.5°C. Colorless to white crystals. Also known as DMG, Alphadimethylglyoxime. Very slightly soluble in water. Very soluble in alcohol and ether. Grades: Technical, Purified, C. P. Containers: Bottles (1 lb.); Tins.

Dimethyl Ketal: See Acetone.

Dimethyl Ketone: See Acetone.

Double Nickel Salt: See Nickel Ammonium Sulfate.

Dragon's Blood: Deep red, amorphous lumps and powder. Natural resin. Soluble in alcohol, ether and volatile and fixed oils. Grades: Various. Containers: Bottles (1 oz.; ¼, 1, 5 lb.).

Duriron: High silicon iron (12-15% Si). Acid resisting.

Earth, Diatomaceous: See Diatomaceous Earth.

Earth, Fullers: See Fullers Earth.

Earth, Infusorial: See Diatomaceous Earth.

Earth Oil: See Petroleum.

Earth, Red: See Ferric Oxide, Red.

Earth Wax: See Ceresin.

Ebonite: Black, hard, vulcanized rubber.

Electrolon: Brand of silicon carbide abrasive.

Electrolyte Acid: See Battery Acid.

Elemi Grum: Resin soluble in alcohol, benzene and turpentine. Grades: Technical. Containers: Boxes, Cartons (1, 5, 10, 25 lb.); Cases (85 lb.); Bags.

Emery: An impure, natural variety of aluminum oxide or corundum, q. v. Contains about 50-60% corundum and 30-40% magnetic iron oxide with various other materials in small amounts. Color is gray to dull black with bluish tinge. Sp. gr. 3.8-4.3. Various grain sizes used for abrasive purposes. Grades: Naxos, Turkish, American. Containers: Tins (1, 5, 10, 25 lb.); Drums (50, 100, 350 lb.); Kegs (100, 350 lb.).

Epsom Salt: See Magnesium Sulfate.

Ethanedioc Acid: See Oxalic Acid.

Ethanol: See Ethyl Alcohol.

Ether: $(C_2H_5)_2O$. Mol. wt. 74.12. Sp. gr. 0.7135. M. P. —116.2°C. B. P. 34.5°C. Colorless liquid. Also known as Sulfuric Ether, Ethylic Ether, Anesthesia Ether, Ethyl Ether, Ethyl Oxide. Very volatile. Inflammable. Solubility, 7.4 at 20°C. Infinitely soluble in alcohol, chloroform, benzene. Soluble in concentrated sulfuric acid. Grades: C. P., C. P. anhydrous (distilled over sodium), Purified, Washed, Motor Primer, U. S. P. Anesthesia. Containers: Bottles, Cans (1, 5 lb.); Cans (25, 27 lb.); Drums (25, 27, 55, 100, 300, 310, 600, 620 lb.).

Ethinyl Trichloride: See Trichlorethylene.

(To be concluded next month)

Abbreviations: Mol. Wt. = Molecular Weight; Sp. gr. = Specific Gravity; M. P. = Melting Point; B. P. = Boiling Point; Solubility figures, where given, are parts by weight in 100 parts of water; Technical = Grade usually used for industrial purposes; Purified or Pure = Better grade than Technical; U. S. P. = Conforms to standards of U. S. Pharmacopoeia; C. P. = Chemically pure, exceeding requirements of the U. S. P.; N. F. = Meets requirements of the National Formulary.

Patents

Plating on Magnesium

U. S. Pat. 2,313,756. W. S. Loose, assignor to The Dow Chemical Co., Mar. 16, 1943. In a method of depositing an electroplate of a nickel group metal upon articles of magnesium and magnesium-base alloys, the steps which consist in subjecting the article to the action of an acidified aqueous etching solution containing a soluble chromate to produce a protective coating on the article, then subjecting the article to the action of a boiling aqueous solution of chromic acid, and then electrolyzing the article as cathode in an aqueous solution containing a soluble fluoride, an acid forming with the fluoride a complex fluo acid, and a soluble salt of the metal to be deposited.

Example:

Dip in 0.25-50% anhydrous hydrofluoric acid solution to improve the adherence.

Then etch in:

Sodium dichromate	10%
Monosodium phosphate	2%
Anodic at 50°C., 5-50 amp./sq. ft., 5-30 minutes	

Then boil for 1-3 minutes in a 20% solution of chromic acid to remove the film formed in the previous step. Finally, nickel plate in a fluoride nickel bath such as:

Nickel sulfate	40 g./l.
Boric acid	20 "
Potassium fluoride	80 "
pH = 5.0-5.5 (adjusted with hydrofluoric acid)	

Corrosion Prevention of Iron and Zinc

U. S. Pat. 2,313,925. L. P. Curtin, assignor, by mesne assignments, to Parker Rust Proof Co., Mar. 16, 1943. A method which comprises obtaining a corrosion resistant coating on a surface composed principally of one of the group consisting of iron and zinc by subjecting such surface to the action of a solution, made up by dissolving in water a solid soluble acid sulphate and a solid soluble sulphite, until a visible protective coating is obtained on the metallic surface and thereafter treating the coated surface with a solution of chromic acid.

Example:

Zinc sulfate	9.0%
Sodium bisulfate	0.75%
Sodium bisulfite	1.75%
Sodium acetate	0.75%
Time=15 sec.	Temp.=80-95°C.

If the temperature is reduced to 30-50°C., the time must be increased to 1 to 2 minutes.

Abrasive Blasting

U. S. Pat. 2,314,069. H. T. Blount, assignor to Mills-Alloys, Inc., Mar. 16, 1943. A wheel for centrifugal throwing of abrasive, including an inner ring, an outer ring, and front and back plates joining the rings, said back plate including means by which the wheel may be attached to a rotating support, a plurality of nozzles extending from the space within the inner ring through said rings substantially to the periphery of the wheel, adjacent nozzles diverging in opposite directions from the plane of rotation passing through their inner ends.

Corrosion Prevention of Magnesium

U. S. Pat. 2,314,341. R. W. Buzzard, Mar. 23, 1943. A method of forming protective coatings on magnesium and alloys thereof in which magnesium predominates, which comprises passing an electric current through the metal at a current density of from 0.5 to 100 amperes per square foot, while the metal is functioning as electrode in an aqueous alkaline solution of a water soluble chromate in which the sole effective coating agent is the chromate.

Example:

Chromate	10%
Sulfate	2%

Anodic or alternating current at 5-10 amp./sq. ft., 50°C. for 20-45 minutes.

Corrosion Prevention of Iron

U. S. Pat. 2,314,565. J. S. Thompson, assignor to Parker Rust Proof Co., Mar. 23, 1943. The method of coating a ferrous surface with an aqueous solution containing a dissolved compound of hexavalent chromium and having a tendency to creep when a film thereof is baked on a metal surface, which consists in producing on the metal surface a chemical reaction the product of which is more soluble than is metallic iron in said solution, leaving at least a trace of said products on the surface and thereafter applying to the surface a film of the solution, dissolving at least some of said products in the film, baking the film, and regulating the first said reaction and the action of said solution so that not more than a minor part of the total coat consists of unchanged products of the first said reaction.

Example:

Cobalt nitrate	2.5 g./l.
Nitric acid	10 cc./l.
Time=30 sec.	Temp.=room.

Corrosion Prevention of Iron

U. S. Reissue 22,296. R. W. Shoemaker, assignor to Agnes J. Reeves Greer, Mar. 30, 1943. The method of treating pickled metal directly after the pickling thereof to neutralize the adhering acid and inhibit rusting of the metal comprising rinsing it in a solution containing caustic alkali and then submerging the metal into a hot solution containing caustic alkali and a polyhydric alcohol taken from a group consisting of glycerine and glycol and then removing the hot metal from the hot solution and permitting the water to quickly evaporate from the surface thereof leaving an impervious film of the polyhydric alcohol thereon.

Example:

First Rinse:	
Water	5600 gal.
Soap powder	10-20 lb.
Caustic soda	50-150 "
Wetting agent	10-20 "
Second Rinse:	
Water	4800 gal.
Soap powder	5-15 lb.
Caustic soda	15-30 "
Wetting agent	5-20 "
Glycerine or glycol	10-25 gal.

Corrosion Prevention of Metals

U. S. Pat. 2,314,887. H. J. Lodeesen and H. K. Ward, assignors to Parker Rust Proof Co., March 30, 1943. In the method of coating metal with a phosphate coating by subjecting the surface of the metal to a phosphate coating solution containing bromate, the step of preventing the escape of bromine by employing in the solution a material in which bromine is readily substituted to form a compound which is not dissociated in the coating solution.

Example:

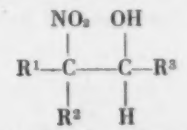
Acid zinc phosphate sol'n	25. lb.
Sodium bromate	0.7 "
Aniline	0.055 "
Water	1 gal.

Apply by spraying for 1 min. at 100-110° F.

The acid zinc phosphate solution is prepared by dissolving 600 lb. of zinc oxide in 2,550 lb. of 75% phosphoric acid and adding to 1,800 lb. of water.

Chemical Silvering Process

U. S. Pat. 2,315.141. P. F. Tryon, assignor to Commercial Solvents Corp., March 30, 1943. A method for producing a silvered reflecting surface, comprising reacting a silver ammonia complex, in the presence of a base, with a nitro-hydroxy compound of the formula:



wherein R^1 and R^2 represent a member selected from the group consisting of hydrogen, hydroxy-alkyl, and alkyl, and R^3 represents a member selected from the group consisting of hydrogen, aryl, and alkyl, such as nitroalcohols, said reaction being effected in the presence of the surface to be silvered.

Example:

Silver Sol'n.:

0.4 Molar silver nitrate	40 parts
15 Molar ammonium hydroxide	20 "
Trisnitromethane	0.4 "

To the above solution are added, at about 30° C. and with continuous stirring, 10 parts of a 2 Molar sodium hydroxide solution.

Instead of the above silver solution the following may be used:

0.4 Molar silver nitrate	40 parts
3-nitro—4-heptanol	1.3 "
Ethyl alcohol	30 "
4 Molar ammonium hydroxide	10 "

Hot Galvanizing

U. S. Pat. 2,315,150. S. H. Bobrov, March 30, 1943. In a galvanizing pot containing molten galvanizing metal, the combination with means for conveying sheets through said metal, of a pair of exit rolls rotatably mounted in the pot and being disposed at least partially in the molten metal, the surfaces of said rolls being composed of closely spaced indentations distributed thereover with substantial uniformity, the indentations being of sufficient magnitude and forming channels for flow of the molten metal axially as well as circumferentially of the roll surface to provide a self-rinsing action

in contact with the sheet in the molten metal, said rolls being loosely mounted so as to only exert sufficient pressure upon the sheets to move the latter therebetween.

Barrel Plating Apparatus

U. S. Pat. 2,315,272. K. T. Potthoff, March 30, 1943. In an electroplating apparatus, the combination of a pair of metallic bearings; a barrel including dielectric heads, each having a central opening adjacent to one of the bearings, and an annular recess on the inner face of the head concentric with the opening; a metallic stubshaft received in each opening and having a smooth exterior and engaged in the adjacent bearing; said shaft having a threaded inner stem in the barrel, and an intermediate disk flange sunk in, and secured to the inner face of, the head; a metallic member having a central opening received on said stem; sealing means between said member and the barrel head; a non-conductive wrench-receiving head held against said stem and engaging said member; said member and wrench head constituting an assembly having threaded engagement with said stem for forcing the member toward the head.

Corrosion Prevention of Iron and Steel

U. S. Pat. 2,315,564. J. S. Thompson and E. W. Goodspeed, assignors to Parker Rust Proof Co., April 6, 1943. In the art of obtaining corrosion resistant paint holding coatings upon surfaces of iron and steel by means of non-electrolytic chemical treatment, the process which comprises applying to surfaces of iron and steel a film of an aqueous solution of chromic acid free from activator ions, baking the film to dry it and bring about a chemical reactior rendering it substantially insoluble, and thereafter applying over said chemical coating a siccative coating.

Example:

Chromic acid	6 lb./100 gal.

Immerse for 2 min. at 212° F. Drain and force dry for 4 min. at 240° F. Then cool and paint.

Pickling Steel

U. S. Pat. 2,315,568. C. J. Wernlund, assignor to E. I. duPont de Nemours & Co., April 6, 1943. A process for cleaning the surface of a ferrous metal article, which comprises making said article the anode in an electrolyte consisting essentially of a solution containing sulfocyanide ions in concentration equivalent to at least about 2 ounces per gallon of alkali metal sulfocyanide and thereafter contacting said article with an acid solution which is capable of dissolving iron oxides.

Example:

Bath 1:	Sodium or ammonium thiocyanate	8 oz./gal.
80° C.	60-70 amp./sq. ft.	1-2 min.
Bath 2:	Sulfuric acid	45%
	Inhibitor	as required
40-60° C.	100-250 amp./sq. ft.	1 min.

This process is claimed to be suitable for iron and steel wire which has lime or other drawing compound on its surface in addition to scale or rust.

Anode

U. S. Pat. 2,315,607. E. W. Ferm and R. O. Hull, assignors to E. I. duPont de Nemours & Co., April 6, 1943. A soluble metal anode cast of a metal selected from the group consisting of brass and copper for use in a cyanide plating bath, the anode containing a metal selected from the group consisting of 0.05 to 5.0 per cent calcium and 0.0005 to 0.5 per cent magnesium and the alloy having been treated prior to casting to a temperature not substantially lower than about 800° C. for calcium and not lower than about 700° C. for magnesium whereby the rate of solution of the anode is decreased by reason of the formation of a bath-insoluble film on the surface of the anode.

Electrolytic Polishing

U. S. Pat. 2,315,695. C. L. Faust, assignor to Battelle Memorial Institute, April 6, 1943. The method of electropolishing a metal or alloy selected from the group consisting of iron and its alloys, nickel and its alloys, and German silver, which comprises passing an electric current from the metal or alloy selected from the group named as the anode through a solution of from about 33 to 50% sulfuric acid and from about 33 to 40% glycerine by weight, the balance being largely water, and continuing to pass such electric current while of a sufficient density for a sufficient length of time to affect the polish of said metal or alloy.

Examples:

For Stainless Steel:

Sulfuric acid	50% by wt.
Glycerol	40% " "
Water	10% " "

300-1000 amp./sq. ft.; 90-200°F.; 3-9 min.

For Monel:

Sulfuric acid	1% by wt.
Ammonium chloride	5% " "
Water	94% " "

750-1000 amp./sq. ft.; 86°F.; 1 min.

For 18% Chromium Steel:

Sulfuric acid	16% by wt.
Phosphoric acid	13% " "
Glycerol	56% " "
Water	15% " "

1000 amp./sq. ft.

For Nickel and Nickel Silver:

Sulfuric acid	33% by wt.
Glycerol	33% " "
Water	34% " "

1000-2000 amp./sq. ft.; 96°F.; 10 sec.

For Steel:

Sulfuric acid	50% by wt.
Glycerol	40% " "
Hydrochloric acid	2% " "
Water	8% " "

50 amp./sq. ft.; Temp. 45°F.; 2 hours

Electrolytic Polishing

U. S. Pat. 2,315,696. C. L. Faust, assignor to Battelle Memorial Institute, April 6, 1943. An electrolytic solution for use in the anodic polishing of metals and alloys selected from the group consisting of iron and nickel and their alloys and German silver, consisting essentially of about 15% of sulfuric acid, 63% of ortho phosphoric acid and 5% of perchloric acid by weight, the balance being mainly water.

Example:

Sulfuric acid	15% by wt.
Phosphoric acid	63% " "
Perchloric acid	5% " "
Water	17% " "

50-250 amp./sq. ft.; Temp. up to 100° C. Time up to 1 hr.

Bright Nickel Bath

U. S. Pat. 2,315,802. R. Lind, W. J. Harshaw & K. E. Long, assignors to The Harshaw Chemical Co., April 16, 1943. An electroplating solution comprising an aqueous, acid solution of a nickel electrolyte of the class consisting of a nickel sulfate and nickel chloride, said solution having the capability of producing bright and ductile deposits of nickel, such capability having been imparted thereto by the inclusion therein of cooperating addition agents, one said addition agent comprising an alkaloid of cycle structure and soluble in the bath to the extent of at least 0.002 gram per liter and mixtures of such alkaloids, said addition agents being present in the solution to an extent to exert their brightening effect and the other of said addition agents being selected from the group consisting of naphthalene sulfonates, the single ring aryl sulfonamides and single ring aryl sulfonimides and mixtures thereof, said second type being present in solution in the bath to the extent of at least 0.2 gram per liter.

Example:

Single nickel salts	240	g./l.
Nickel chloride	37.5	"
Boric acid	37.5	"
Sulfonated naphthalene	4.0	"
Sodium lauryl sulfate	0.25	"
Quinine bisulfate	0.010	"

pH = 3.0
Temp. = 50° C.
C. D. = 40 amp./sq. ft.

Corrosion Prevention of Steel

U. S. Pat. 2,315,852. W. E. Gordon & J. E. Williamson, assignors to Remington Arms Co., Inc., April 6, 1943. The method of imparting corrosion resistance to a ferrous metal body comprising treating said body by subjecting the surface thereof to an aqueous solution consisting of an inorganic nitrite, water and a wetting agent comprising sodium lauryl sulphate, borneol terpene and an alcohol; and thereafter removing the solvent by drying said body.

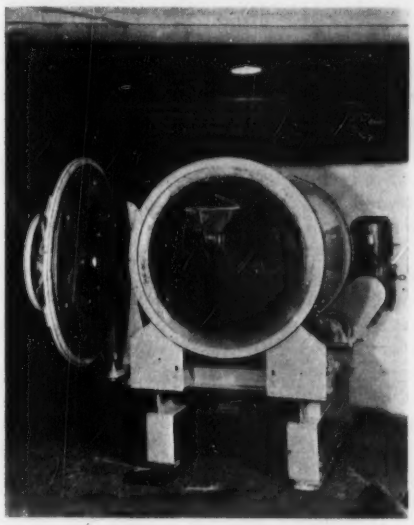
Example: 0.1-3% by wt. of sodium nitrate plus 1% of the following wetting agent:

Sodium oleyl sulfate	13.5-15% by wt.
Water	36.5-35% " "
Borneol terpene	40% " "
Ethyl alcohol	10% " "

This solution is allowed to dry on the surface.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY



New Air Blast Barrel

This air blast barrel, developed by Dreisbach Engineering Corp., Dept. MF, 45 Warburton Ave., Yonkers, N. Y., has a newly designed, all steel barrel and frame, including other improvements, such as adjustable bearings for roll shaft and direct roller chain drive (enclosed) from 2 h.p. gear-motor mounted on right hand rear corner. The ½" steel lining plates inside the barrel are securely held in place with through bolts, and may be replaced by removing nuts outside the barrel.

Special attention is called to the new improved dust exhaust which removes dust from the barrel through the large diameter perforated plate at the rear end. The holes in the door are staggered to prevent escape of the abrasive and to permit a large volume of air to pass through the barrel. The exhaust pressure is approximately two ounces; the maximum volume required for operating the barrel at any air pressure up to 100 pounds is about 400 cubic feet per minute to remove the in-put air from the blast nozzles, plus sufficient volume through the front door, so that there is no dust around the machine while in operation. The clean abrasive passes through the perforations in the lining plates into the outer barrel or drum; the buckets between the lining plates and outer barrel return the abrasive to the stationary hopper, through lining plate perforations and a removable hopper screen. This screen removes core wires and nails from the abrasive.

The all-steel door, having a soft rubber gasket, closes against the machined surface of the front barrel ring, and is locked in place with a larger diameter hand wheel operating six steel bolts under annular beveled ring.

This machine is said to be especially suitable for descaling, cleaning, mat or frost finishing bronze, gray, hard, and malleable iron, or steel castings, forgings, heat-treated springs and stampings in batch lots of one to four shop boxes. The barrel revolves from only one to two turns per minute—just enough to expose all surface and material to the blast from four nozzles. This slow speed makes it possible to clean very delicate and fragile articles without breaking. The time required—five to thirty minutes per charge—varies in relation to the operating air pressure and type of abrasive (sand, grit, or shot) and also the conditions of material and the finish required.

Abrasive Belt Backstand Idler

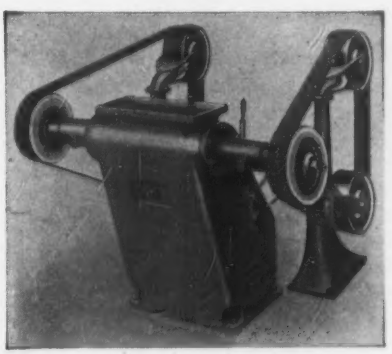
Abrasive Belt Backstand Idler No. 120 has been developed by the Jones Engineering Co., Dept. MF, Ellwood City, Pa. The new unit, a floor-type model especially designed for crowded grinding and polishing departments, can be connected to any regular grinding or polishing lathe.

The new model takes a minimum of floor space, due to a unique vertical arrangement of pulleys. Thus, finishing departments with their grinding lathes set too close to the wall for use with other types of backstands, can equip the lathes with these new backstand idlers.

Conversion of regular lathes to belt grinding with this backstand, using factory-coated abrasive belts and patented Segment-Face contact wheels, is said to result in faster, better, easier and more uniform grinding.

Other features of the new abrasive belt backstand idler include conveniently located controls at the front of the machine, adjustable spring belt tightening and positive screw belt aligning. The backstand will take any belt size up to 6" wide, is designed for belt speeds up to 10,000 surface feet per minute, and is so built that simple dust collecting hoods can easily be installed.

Complete instructions are given with each unit. A bulletin, free upon request, has been released which describes this new unit.



Floor-type backstand idler.

Eye-Shield

A means of combining convenient, nonfogging eye protection with the company's Skullgard for head safety is now available in the M.S.A. Skullgard-Eyeshield, according to the manufacturer, Mine Safety Appliances Co., Dept. MF, Braddock, Thomas and Meade St., Pittsburgh, Pa.

The Eyeshield, designed to deflect hazardous flying particles, may be quickly and easily attached to any Skullgard already in use, it is stated. Affording full vision and comfort, the transparent, plastic shield is so hinged that it is readily positioned before the eyes in proper facial curvature by a downward flip, and when not in use, lies flat against the brim.

The Eyeshield may be ordered with all types of Skullgards and Comfo Caps, or may be ordered separately for attachment to those hats and caps already in service. Bulletin CE-18 gives instructions on attaching the assembly.

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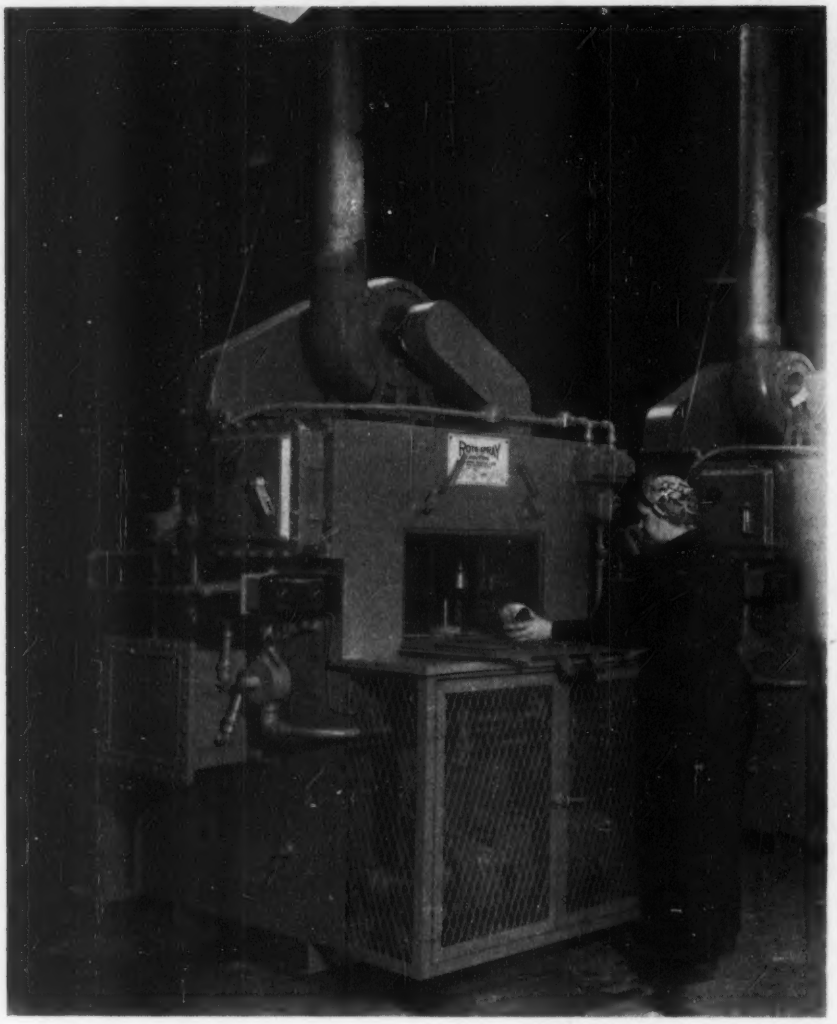


New Washing Machine

The machine pictured above, manufactured by the Industrial Washing Machine Corp., Dept. MF, New Brunswick, N. J., is known as the "Rotospray" washing machine.

The machine consists of a rotating mesh turntable two feet or larger in diameter, housing, pump, motor and spray system. The parts to be cleaned are placed upon the mesh turntable, the door closed and the valve turned which allows the cleansing solution to spray upon the work. As the parts are sprayed, a gearhead motor rotates the turntable in order to expose all sides of the work to the spray action which is directed by specially machined nozzles from the top, sides and bottom.

After the work has been cleaned, it can be rinsed with fresh water if so desired. This fresh water does not drain into the solution tank, but passes directly to the sewer by means of a tilting drain plate which is coupled to the fresh water valve handle.

Any of the cleaning detergents now on the market can be used in the machine.

Machines of this type are now being used to clean such parts as ball bearings, large castings, crankcase parts, nose sections, large cams and gears, impeller shafts, diesel engine blocks, etc.

The machine pictured here is intended for use with kerosene; hence, the explosion proof switches and wiring and "built-in" CO_2 fire protection system.

Protective Skin Cream

Tarbonis Cream is a modified tar product based on a formula developed in a medical institution and used successfully in that institution's dermatology and pediatrics departments for over eight years, according to the manufacturers, The Tarbonis Co., Dept. MF, 1220 Huron Rd., Cleveland, O.

It is recommended where there is occupational dermatoses whether due to chemical irritation, chronic exposure to abrasives, work with cutting oils, reagents, acids, and many conditions that cause difficulty to increasing numbers of factory workers.

The cream itself is greaseless, and is claimed to be clinically non-allergic and non-irritating, and safe for use by the worker at home as well as in the plant.

Floodlighting Projectors

To meet wartime needs for protective floodlighting and lighting of yards, areaways and other outdoor work places, the Benjamin Electric Mfg. Co., Dept. MF, Des Plaines, Ill., have made available the Type RDS Floodlighting Projectors.

Replacing the company's Type RD Projectors, these seamless steel housing units embody all the features of the previous models with the exception that all parts formerly made of aluminum, brass or other nonferrous metals are now furnished in steel or cast-iron specially treated by porcelain enameling, and other rust-proofing to render them resistant to corrosive atmospheric influences and weathering.

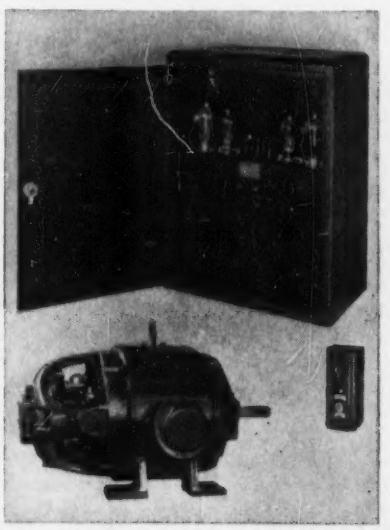
Electronic Adjustable Speed Drive

For application on industrial drives, such as machine tool feeds, winding reels, conveyors, and fabricating and converting machinery, an electronic adjustable-speed drive, the Mot-O-Trol, has been announced by Westinghouse Electric and Manufacturing Co., Dept. MF, East Pittsburgh, Pa. The equipment is said to provide close speed regulation over a 20 to 1 speed range for d.c. motors operating from an a.c. source.

Features of the electronic drive include stepless speed control, automatic close speed regulation over wide load fluctuations, full torque at low speeds, smooth stepless acceleration and deceleration and dynamic braking. A standard drive is available for ratings up to 1 horsepower for single phase operation on 110 or 220 volt, 60-cycle systems. Special drives of larger horsepower rating can be designed to suit particular application requirements.

The drive has four parts. These are (1) power transformer for separate mountings, (2) Mot-O-Trol cabinet with the thyratron-tubes and the current limiting and speed regulating control, (3) control station with potentiometer to vary the voltage supplied to the armature and field circuits and with start and stop push buttons, and (4) shunt-wound d.c. motor.

The standard Mot-O-Trol is designed to automatically regulate a preset motor speed so as to maintain essentially constant speed regardless of load. The d.c. voltage output of the main rectifier tubes is controlled by small tubes to compensate for speed changes. For a speed range of 10 to 1, with torque varying from no load to full load, speed will not vary more than four per cent from a preset value, it is claimed. Maximum variation for the 20 to 1 speed range is within eight per cent. No additional rotating part, other than the d.c. motor is required. No separate line starters or field rheostats are necessary.



Electronic control cabinet, push button control station and d-c motor for Mot-O-Trol.

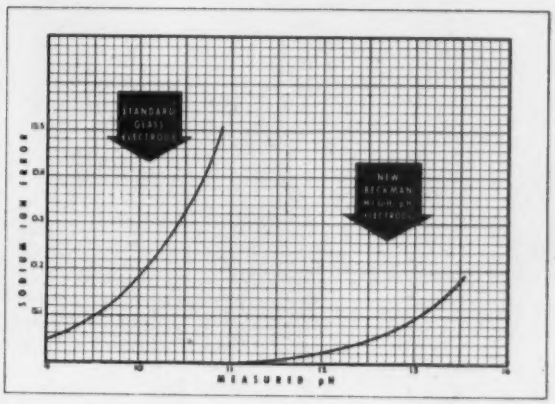
BECKMAN pH NOTES

BETTER PLATING THROUGH MODERN pH CONTROL

NO. 2 OF A SERIES

Showing how pH affects plating of brass, cadmium, zinc, copper and similar metals.

HOW THE BECKMAN "TYPE E" ELECTRODE IMPROVES MODERN PLATING EFFICIENCIES



THE ABOVE CHART shows the accuracy of the Beckman "Type E" Electrode as compared with conventional glass electrode when operating in highly alkaline baths where sodium ions are present. Note how the conventional glass electrode becomes increasingly inaccurate at even relatively low alkaline values, becoming useless at pH values above 11.

In contrast, the Beckman "Type E" Electrode requires no correction whatever at pH 11 and only very small correction at values as high as 13.5 pH!

No other make or type of glass electrode pH equipment has this vital advancement so important to modern high speed plating processes!

THE glass electrode is universally recognized as the most accurate and convenient method of controlling pH in process solutions. But in many alkaline plating baths—particularly cyanide baths for brass, copper, cadmium and zinc plating—operators were unable to use conventional glass electrode equipment to full advantage because of the excessive correction factors necessary.

Then the Beckman research staff made an important development—the Beckman "Type E" Glass Electrode—an electrode that can be used in highly alkaline solutions, *even in the presence of sodium ions,* with little or no correction necessary.

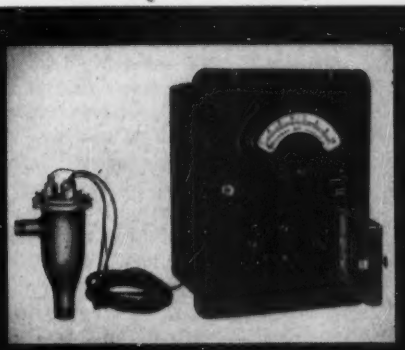
This electrode has been described by recognized plating authorities as "the first practical and accurate method for pH control of cyanide plating baths." With it, more uniform deposits can be obtained—at higher plating speeds—with fewer rejects!

Whether your plating operations are on a small or large scale, investigate the vital savings in time and material that you can make with Beckman pH Control. There's a Beckman pH instrument to fit *your* requirements. Write for detailed information!

SEND FOR THIS FREE BOOKLET

"What Every Executive Should Know About pH" . . . an interesting, informative booklet on the fundamentals of modern pH control. Ask also for Bulletin 86 which lists and describes Beckman instruments, electrodes and accessories!

BECKMAN INSTRUMENTS DIVISION
NATIONAL TECHNICAL LABORATORIES
South Pasadena California



THE BECKMAN AUTOMATIC pH INDICATOR is the most advanced pH instrument available for large-scale plating operations. Automatically indicates, records, and controls. *Ask for Bulletin 16!*

THE BECKMAN INDUSTRIAL pH METER is ideal for portable plant and field use in the electro-plating plant. Highly accurate, simple to operate, ruggedly built. *Ask for Bulletin 21!*

Inter-Communication System

Talk-A-Phone Mfg. Co., Dept. MF, 1219 W. Van Buren St., Chicago, Ill., have announced a new line of inter-communication systems.

As noted by the diagram above of the "Super-Chief" model, many new, exclusive features are used. "Conference Traffic Control" enables any number of stations to hold a private conference without interruption or eavesdropping from other stations outside of the conference group. When one of the conference group is being called he is signalled by a light so that he knows that the call is waiting. Working in conjunction with the Traffic Control is the "Busy Signal Light." This light is illuminated when the line on another station you are trying to reach is busy and so remains lighted until that station is ready for a new conversation.

Other features include "Uni-Trans" or one way automatic transmission, especially effective for the dictation of letters and the complete recording of conferences. When "Uni-Trans" is used, the "Talk-Listen Switch" does not have to be operated.

The amplifier designed for these units is said to deliver an undistorted output of five watts and to permit operation with undiminished power and efficiency with the units as far as 3000 feet from one another. Each station is equipped with individual volume control so that incoming volume may be adjusted to suit individual requirements.

Optional equipment is a privacy earphone. When the earphone is used, Talk-Listen switch does not have to be operated and the unit works the same as a telephone. The volume for the earphone may be adjusted.

Super-Chief is available in systems consisting of from 2 to 10 or 20, 30, 40, 60, 80, etc. stations.

Portable Reciprocating Action Electric Tool

H & H Research Co., Dept. MF, 444 Marquette Building, Detroit, Mich., have announced a new push-and-pull action portable electric tool. Like their previous models, the new tool is designed for use in filing, burring and chamfering; honing; polishing and lapping; scraping, sawing and sanding. It retains the basic reciprocating principle of former models, but differs from them with respect to design.

A new pistol grip, equipped with a conveniently located finger control switch and shaped for quick and easy handling, has been provided.

The fan, air inlets and air outlets have been redesigned for larger capacity, to insure the handling of a greater volume of air, resulting in an improved motor cooling system.

A spiral wire cord protector is provided to prevent the cord from slipping in or out or being damaged by sharp turns or twisting. A heavier armature is used, and the work spindle is equipped with three bushings instead of two, as in the older models.

This new tool is made in two models, having different push-and-pull stroke lengths. Model CX has a 3/16 inch stroke; Model EX a 1/8 inch stroke. Rate of stroke is 1000 to 1200 per minute, for either model. Power of stroke is a 30 to 40 pound push or pull, developed at the working end. Total weight of either model is five pounds.

Descriptive literature will be sent on request by the company.

Reciprocating electric tool with pistol grip.

Dunking and Dryer Basket

The Curran Corporation, Dept. MF, Malden, Mass., have announced a newly patented Dunking and Dryer Basket.

This new Dunking Basket Kit is said to be extremely practical since it is included with a standard five-gallon steel shipping pail with a removable top containing the company's newly announced Carbon Met substitute for carbon tetrachloride.

The bench kit is shipped complete and is easy to use. The part to be cleaned is simply placed in the dunking basket and it bursts into volatile Carbon Met.

On withdrawing the basket, the spring-like clips attach themselves to the edge of the container, allowing excess solvent to drain back into the pail. Within a very few minutes the parts in the basket are completely dry and clean, according to the manufacturer.

The unit is constructed entirely from extra pieces and scraps of new metal. Therefore, it is not necessary to have a high priority to purchase it.

Wet and Dry Abrasive Belt Grinder

A new 6" Wet and Dry Abrasive Belt Grinder has just been placed on the market by Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich., and is pictured above.

Aside from the new heavy large cast base and larger sludge pan and new pulley-motor mountings which are easily adjusted from outside the base, the machine can be adjusted from vertical to horizontal position while it is running. The belt tension and tracking device can likewise be adjusted while running by two conveniently located handles. The machine is totally enclosed and is arranged for an individual dust collector or for connection to an exhaust system. The abrasive belt pulleys are made of cast iron and are dynamically balanced. They run on dust-proof ball bearings and are properly lubricated. The work table can be adjusted to the desired working angle and is available as a bench or floor model. Called the Hammond "600" Wet-N-Dri Machine, it has the features of the Hammond "6600" Dri plus providing wet operation for grinding, polishing or surfacing. It is equipped with tank and pump unit and can also be equipped for water-main connection only. Both are equipped with damper or spray cotrol and two nozzles for uniform spraying. Should dry operation be desired at any time on either machine, it is necessary to merely turn off the water, remove drain connection and attach air exhaust system at this point. The unit is adjustable from vertical to horizontal position while running. Vacuum cup drive pulleys eliminating belt slippage furnished on wet machines only.

THIS *Perfect* WATCHMAN *is always on the job!*

New *Automatic* Tank Control Hailed by Plating and Finishing Industry

A long-felt need, and especially valuable in these days of labor shortages and inexperienced help, this new "Automatic Tank Watchman" provides positive control of solution levels, temperature and time.

Outstanding Feature at Electroplaters' Convention

One of the most-talked-of exhibits at the recent Buffalo Convention, the Electronic Tank Controller was the center of interest activity at all times. Years of practical experience in the plating industry, plus months of painstaking proving, guarantee its perfect performance.

Requires No Major Reconstruction

Can be attached to your present equipment at small expense. Will . . .

1. **Keep tank at constant level**
2. **Maintain solution at correct temperature**
3. **Warn operator of any leaks or over-filling**
4. **Not operate from waves**
5. **Prevent imperfect work**
6. **Automatically start and stop tanks. Can be set for full week schedule**

Practically fool-proof, the Electronic Tank Controller works "without pay." Can be immediately installed by your own electrician on any type of tank without boring holes or making major changes. Guaranteed to perform all the duties we claim, without fuss or bother.

Write today for folder of complete details of all models and prices

Plating Processes Corp.
HOLYOKE MASSACHUSETTS

The All-Essential factor in Cyanide Zinc Plating, Bright Zinc Plating and Lead Plating is a clean metal surface. TURCO has developed two Specialized Chemical Compounds which assure quick, thorough cleaning preparation for these operations.

TURCO PENETROL . . . is a potent degreaser which impregnates foreign matter with an emulsifying agent and mutual solvent by simple immersion. PENETROL removes paints and lacquers quickly, thoroughly, and is harmless to the basic metal.

TURCO POROKLEEN . . . is the answer to final pre-plating cleaning. The quick action and chemical efficiency of its wetting-out process assures no deposits of waste or film. POROKLEEN is free-rinsing and leaves metal pores clean and ready for plating.

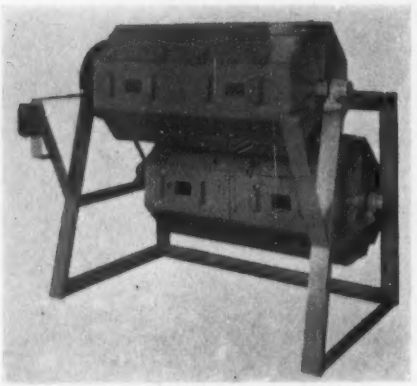
TURCO PRODUCTS, INC.
Los Angeles — Chicago
Main Offices and Factory — 6135 S. Central Ave., Los Angeles, Calif.
Midwest Factory — 4856 S. Halsted Street, Chicago, Ill.
Service Representatives and Warehouse Stocks in All Principal Cities

MAIL THIS COUPON

TURCO PRODUCTS, INC.
6135 South Central Avenue • Los Angeles, 1 Calif. 27-73

Please send complete information on precleaning and final cleaning with Turco Penetrol and Turco Porokleen, before plating operations.

NAME _____ TITLE _____
FIRM _____
ADDRESS _____ STATE _____



New Deburring Equipment

Sturgis Products Co., Sturgis, Mich., are the manufacturers of this new Roto-Finish method of deburring, buffing, honing, grinding and polishing parts made of steel, brass, aluminum, stainless or nickel steel, etc., machine products, turret lathe products, milling machine products, stampings, castings, die castings and drop forgings.

It is said that this mechanical method will handle much of the finest precision work produced in the manufacture of airplane parts, machine guns, and other war production parts. Thousands of parts—small or medium—can be deburred, buffed, polished or colored either before or after plating, it is claimed.

The process is available either wet or dry. The Wet Process is especially designed to handle heavy gauge stampings, large irregularly shaped parts; or where a particularly smooth, bright finish is required. The Dry Process can be used for handling brass castings, light gauge steel and brass stampings and die cast pieces before plating. It smoothes the surface and edges through abrasive action, and at the same time imparts a bright finish as a result of the coloring properties of the Dry Finishing Compound.

The Roto Jr., is designed for those plants where the size and quantity of the work is too small for the larger units.

Frederic B. Stevens, Inc., of Detroit, are distributors for Roto-Finish equipment.

Polishing Wheel Adhesive in Convenient New Form

The Lea Manufacturing Co., Dept. MF, Waterbury, Conn., announce the marketing of their Ad-Lea-Sive in a new bar form.

The product thus is described by the manufacturers as being more convenient, more practical and more economical to use.

It is applied direct from bar to wheel, melting being accomplished by friction heat.

This special glue-base sizing is used with Lea Compound for burring and polishing operations and for many heavy cutting jobs.

Wheel Dryer

Park Chemical Co., Dept. MF, 8074 Military Ave., Detroit, Mich., have announced the development of their new infra-red dryer for polishing wheels.

The distance from the lamps to the wheels is adjustable and various diameter wheels can be mounted on the drying shaft by the use of special bushings.

The unit is 54″ square and 66″ high and is equipped with casters for portability.

New Metal Cleaners

A new line of cleaners and de-oxidizers for aluminum, copper, nickel and galvanized metals is announced by Nielco Laboratories, Dept. MF, 19720 Florence Road, Detroit 19, Mich.

These cleaners are compounded for both still tanks and power washing machines. It is claimed that oil as heavy as SAE 50 can be removed in only a few seconds at boiling temperatures.

The company also markets a line of skin protective coatings of both the cream and the lotion type for industrial purposes.

Koroseal Tank Linings

A method of bonding solid sheets of Koroseal directly to the welded steel, wood, or concrete of tanks, and thus extending the application of tank linings into fields which rubber cannot handle because of physical limitations, is announced by the B. F. Goodrich Co., Dept. MF, Akron, O.

Koroseal is the plasticized polyvinyl chloride developed in the company's laboratories. It is a synthetic elastic material with many rubber-like properties.

The principal advantage of Koroseal in tank lining is its remarkable corrosion resistance because of the inertness of its compounds to strong corrosives such as chromic and nitric acids, which have a deteriorating effect on rubber.

The company declares that Koroseal linings are the most important now being offered in the synthetic field. Research is continuing on others.

In announcing the Koroseal linings the company points out that the material has certain limitations both in temperature ranges and effects of various chemicals on it, and that it is essential that company engineers be furnished complete service details before the material can be recommended.

The new linings, made in sheets, are three times thicker than an earlier type, which employed fabric backing. This increase in thickness makes them withstand physical damage much better.

Advantages of the lining are cited as follows:

It can be applied in thicknesses up to and including 3/32″.

It is not subject to physical damage and pin hole leaks suffered by many corrosion resistant paints. It will not, however, withstand physical abuse and metallic gouging. For such service an oversheathing of acid resistant brick is recommended.

It is more resistant to abrasion than corrosion-resistant paint films.

It is readily repaired if damaged.

It has high electrical resistivity and prevents current losses in electrotlytic action.

It can be easily tested for leaks with an electric tester.

It is highly resistant to oxidation, water, sunlight, and gas diffusion.

Acid, Water, Oil Resistant Floors

A new industrial floor product of the Flexrock Co., Desk H-7, 2300 Manning St., Philadelphia, Pa., it is asserted resists the penetration of acid, water, oil and grease. Hence, the name—A-W-O-G. In addition to its imperviousness, an AWOG floor is said to be durable, smooth and dustless, and to withstand traffic such as the rolling of drums or barrels and the grinding steel wheels of heavily laden trucks.

The product is recommended for new floors; for overlays on concrete, brick, stone, or wood; for repairing and resurfacing areas of any size.

Magnesium Dust Control

The Type N Roto-Clone Bench illustrated below was developed especially by engineers of the Dust Control Division, American Air Filter Co., Inc., Dept. MF, Louisville, Ky., for safety in burring, filing and flexible shaft grinding of magnesium. The design provides a semi-enclosed bench assembly with down draft ventilation through wood grilles and is furnished complete with tool shelf, fluorescent lights and partitions between stations.

The Type N Roto-Clone is also available in small individual units which can be located directly in back of magnesium grinding stands. Inlets are placed so that exhaust ducts are short and run directly into the collector—an important safety feature.

The distinguishing feature of the Type N Roto-Clone is the elimination of all restrictions, ledges or recesses where damp magnesium dust could be deposited. The magnesium dust is precipitated and stored under water. No magnesium particles can pass to drain, since any overflow consists only of excess makeup water that might be required to maintain the proper liquid level. Any hydrogen resulting from the reaction of magnesium and water is automatically vented whether fan is stopped or in operation.

The Type N Roto-Clone Unit also has proved effective for the collection of fibrous and greasy dust from buffing wheels, so eliminating the fire hazard inherent with this material, it is said.

The benches and units are made in a wide range of sizes with capacities from 1,000 to 20,000 CFM. The benches are furnished single with one to three work stations or double (back to back) arrangement with as many as six stations. For further information write the company, requesting Bulletin No. 277.

Manufacturers' Literature

Metal Cleaning Handbook

The Magnus Chemical Co., Inc., Dept. MF, Garwood, N. J., manufacturers of metal cleaning materials, metal drawing lubricants and washing, drying and pickling equipment, have just issued a new, 72-page illustrated manual, "The Metal Cleaning Handbook."

The handbook provides an organized means of selecting cleaning materials, methods of use and types of washing equipment best adapted to efficient cleaning of various kinds and shapes of metal articles.

The first half of the manual is devoted to cleaning materials and the factors governing the selection of such compounds. Each of the four main classes of cleaning materials, namely, solvent cleaners, petroleum spirit cleaning, alkaline cleaners and emulsifiable cleaners is discussed separately. Under each is indicated the kinds of metals and articles each is best suited for, its major uses and its disadvantages.

In the section of alkaline cleaners are discussed the following operations: cleaning after drawing and stamping, cleaning die cast parts, cleaning after salt bath annealing, cleaning after slush oils and rust preventives, cleaning after buffing and polishing and cleaning for a chemically clean surface.

The second section of the manual discusses modern washing machines. All types, from simple dip tanks to fully automatic, continuous conveyor machines for washing, rinsing, drying, cooling and pickling operations are reviewed. These machines, besides being described in the text, also are pictured in blueprint form. Several tables, charts and pictures complete the section.

The balance of the manual discusses related metal processing operations such as drawing, lubricating, burnishing and antirusting.

Synthetic Rubber Booklet

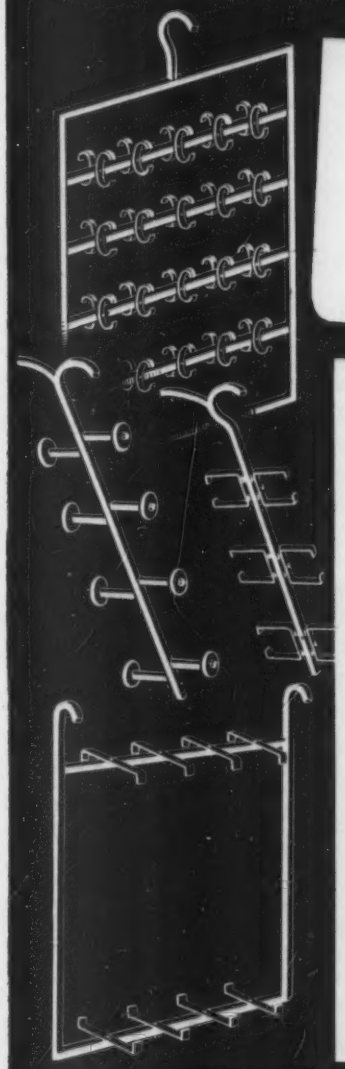
United States Rubber Company, which recently placed in operation the world's largest synthetic rubber plant at Charleston, W. Va., has used all available types of synthetic rubber in its products since 1932, according to a booklet, "The Five Commercial Types of Synthetic Rubber," released by the company.

The booklet traces the development of synthetic rubber from its laboratory beginnings, describes the properties of the commercial synthetic rubbers, and relates the part played by the company in their development, manufacture and use.

The publication includes photographs of synthetic rubber manufacture, diagrams, and a chart giving the relative physical and chemical properties of natural rubber and of the five types of synthetic rubber.

The booklet, which has had a limited distribution to government agencies and allied industry, is now made available free upon application to the *United States Rubber Co.*, Synthetic Rubber Division, Dept. MF, 1230 Sixth Ave., New York, N. Y.

PLATING OR ANODIZING RACKS...



We just make them LAST LONGER and COST LESS!

Because BUNATOL liquid insulation is more flexible—and stays that way—it lasts longer. . . . Because it lasts longer it costs less to use. . . . Because it multiplies rack life, permits increased production, prevents waste of critical materials, cuts current consumption, is easy to apply, fast air-drying and does not crack or peel it insures more production and less grief. . . . BUNATOL is the perfect insulation for chromic or sulfuric Anodizing Racks; for tin, silver, zinc, cadmium, copper or chromium Plating Racks. . . . Ask any of the hundreds of plants, large and small, who use it.

May we send YOU complete information about BUNATOL?

NELSON J. QUINN COMPANY
Toledo 7, Ohio

BUNATOL ENGINEERED RACK INSULATION

Wood

A new, illustrated book for executives and engineers—*Wood and Its Place in the War Effort*—is available without charge to companies engaged in war work. Published in limited edition. Write to *Kay Displays, Inc.*, Dept. MF, 9 East 40th St., New York, N. Y.

Multiplaters

W. Green Electric Co., Inc., Dept. MF, 130 Cedar St., New York, N. Y., have just issued a four-page folder in connection with their new multiplaters.

Six diagrams of multiplater layouts are featured.

Solvent Degreasers and Cleaners

A new bulletin, Form No. 11543-1 SUP, describing the uses of the four available types of Cyclodiene Base Hydro-Carbon Solvent Degreasers and Cleaners for metals, will be mailed free to any inquirer.

An interesting section deals with painting or lacquering on wet surfaces immediately after the work comes out of the bath, which is operated at room temperature.

Another paragraph tells of the protective rust inhibitive film left on the surfaces of the work after being degreased in Cyclodiene. Address Dept. W, Technical Processes Division of *Colonial Alloys Co.*, 2154 E. Somerset St., Philadelphia, Pa.

RIGHT ON THE TARGET!

WITH McALEER MILITARY PYROTECHNICS

. . . Quality Controlled Finishing Materials . . . Other Vital War Products

Military pyrotechnics alone are not all of the war time products of the McAleer Manufacturing Company — there are others which extend into the fields of military aeronautics and hydraulics — embrace complete industrial finishing materials — metal and plastic — with a helpful advisory service — yours to command.

McAleer MANUFACTURING CO.
Quality-Controlled Finishing Materials
ROCHESTER, MICHIGAN

Safety Equipment Maintenance

The care and maintenance of such safety devices as respirators, goggles, face and eye shields, welding helmets, rubber gloves, etc., are reviewed in a new, five-page report, just issued by *Oakite Products, Inc.*, Dept. MF, 18 Thames St., New York, N. Y.

The four essential steps in handling maintenance of respiratory and other equipment are described, together with recommendations and detailed instructions.

It is pointed out, for example, that strong alkalis should be avoided for cleaning aluminum and aluminum alloy parts of safety equipment and that rubber parts, because of their particular sensitivity to strong solvents, grease, oil, etc., should be cleaned with mild detergents. The report cautions against the use of strong alkalis or solvents when cleaning fibre helmets with special varnish or lacquer finishes for the reason that such materials may remove these protective coatings.

Before chemical treatment is applied to the glass shields in welding hoods to lessen breakage and prevent slag adherence, glass surfaces should be free of oil, grease, paint, etc. A method for putting glass in this condition is outlined.

The subject of germicidal treatment of respirators, goggles, etc., by several different methods is also discussed.

Remote Mechanical Controls and Shaft Assemblies

A new book covering problems of remote controls, Universal joints, shaft joints, shaft couplings, shaft hangers, shaft assemblies, hinged joints, Universal joint covers, shaft expansion couplings, operating gears, engine controls, steering controls, valve controls, manual ventilation controls, etc., has been released by the *Brooks Equipment Corp.*, Dept. MF, 90 West St., New York, N. Y., and the Brooks Equipment Corp. of California, with offices in San Francisco and Los Angeles, Cal.; Seattle, Wash., and Portland, Ore.

This book provides descriptions of two new joints; the consolidated hinged joint with positive and effective operating range at angles from 0° to 92° in any one given plane, and the company's Universal joint with positive and effective operating range at angles from 0° to 360° in any plane.

Along with the descriptions are data sheets and blueprints of the joints themselves and the brackets, expansion couplings, assemblies, shaft hangers and accessories used for their installations.

A registered copy of this book will be sent free to any reader.

Government Agencies

The "Handbook of Emergency War Agencies," prepared by the Office of War Information, is a guide to Federal agencies all of whose present functions are devoted to the war activities. It does not include the activities of the agencies established for other purposes, even though much of their work today has been integrated with the war program. The handbook is designed to help the public reach the services it needs within the emergency war agencies.

Copies of the handbook may be obtained by writing to Superintendent of Documents, Government Printing Office, Washington, D. C. Price: 20c each.

Standards List

The American Standards Association has announced publication of their new List of American Standards which will serve as a reference piece to the engineering and purchasing departments of manufacturing firms.

More than 600 standards are listed, 94 of which represent new and revised standards approved since the last (August, 1942) issue. These are marked with an asterisk.

Standards are listed by subject and cover civil, mechanical, electrical, mining, chemical and other engineering fields as well as metals and materials, specifications of interest to the textile, wood, pulp and paper industry, methods of test for the finished product, dimensions, etc.

This List of American Standards for 1943 will be sent free of charge to anyone writing in for it. Requests should be addressed to the American Standards Association, 29 West 39th St., New York, N. Y.

New Books

Journal of the Institute of Metals. Volume LXVIII. Edited by N. B. Vaughan. Published in London by The Institute of Metals, 4 Grosvenor Gardens, S. W. I. 1942. 430 pp. 37 plates and numerous illustrations. Price £2 net or, with *Metallurgical Abstracts*, Vol. IX, 1942, £4.

The complaint has frequently been made that the Institute of Metals caters too much to the research worker and too little to the man in the works. It is difficult to see how this charge can be sustained when in the volume of the *Journal* for 1942, there are papers of such immediate importance to war production as the following: "The Cold-Pressing Properties of Duralumin-Type Alloy Sheets, with Special Reference to the Production of Large Pressings for Aircraft," by J. C. Arrowsmith, K. J. B. Wolfe, and G. Murray; "Railway Bearing Metals: Their Control and Recovery," by J. N. Bradley and Hugh O'Neill, containing a description of a new process for the separation of mixed bronze and white metal borings; "The Use of Fired Small-Arms Cartridge Cases in the Production of Some Alpha-Beta Extrusion Brasses: Indications of the Effects on the Physical Properties of the Extruded Rods," by John Rae, Jr.; "The Properties of Commercial Coppers Containing Selenium, Tellurium, and Bismuth," by G. L. Bailey and A. P. C. Hallowes; "The Effect of Selenium, Tellurium and Bismuth on Deoxidized Copper for Tube Manufacture," by Maurice Cook and G. Parker; "The Grain-Size of Rolled Aluminum," by H. W. L. Phillips; "The Effect of Zinc, Nickel, Lead and Tin on the Properties of L.3 Alloy Sheet," by Maurice Cook and R. Chadwick; "An Investigation of the Factors Governing the Adhesion of Tin-Base Bearing Metals," by W. T. Pell-Walpole, J. C. Prytherch and P. Chalmers. The first two of these evoked long and interesting discussions which are reproduced in full. There also appears Mr. W. T. Halcrow's May Lecture on "Water Power and Its Application to the Production of Metals," illustrated by photographs of eight hydro-electric plants in various parts of the world.

A. S. T. M. Standards on Copper and Copper Alloys. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. 1943. 385 pp., paper cover. Price: $2.25 per copy or in orders of ten or more, $1.75 each.

With over 85 standards, this book gives in their latest approved form, as of February, 1943, all A.S.T.M. standards on copper and copper alloys covering cast and wrought material, alloys used for electrical conductors, and non-ferrous metals used in copper alloys. Published under the sponsorship of A.S.T.M. Committees B-1 on Copper and Copper Alloy Wires for Electrical Conductors, B-2 on Non-Ferrous Metals and Alloys, and B-5 on Copper and Copper Alloys, the book provides specifications widely used throughout industry and by the government in connection with the war effort. Important features in the publication are the emergency alternate provisions and emergency specifications to aid in expediting procurement.

Fifteen of the standards cover copper and copper-alloy wire and cable including the new emergency specification for lead-coated and lead-alloy coated copper wire. There are 13 specifications covering non-ferrous metals used in copper alloys such as lake copper, fire-refined copper (other than lake), phosphor tin, nickel, pig lead and the emergency specification covering fire-refined copper, termed "Braden." In the field of copper-plate, sheet and strip, there are 16 specifications which include cartridge brass sheets, case cups, gilding metal, etc.; 15 standards pertain to rods, bars and shapes; and nine to copper pipe and tubes.

The compilation includes the specifications on copper-base alloys for sand castings and the standard methods of test including expansion test (pin test), mercurous nitrate test, hardness conversion table and other test procedures.

Selection and Maintenance of Respiratory Devices

Information Circular 7236 covers the selection, use and maintenance of respiratory protective devices. By H. H. Schrenk & S. J. Pearce. 12 pp. Obtainable free of charge from Office of Minerals Reports, U. S. Bureau of Mines, Washington, D. C.

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Associations and Societies

American Electroplaters' Society
Los Angeles Branch

When monthly meetings are resumed by the Los Angeles Branch on September 6, the membership will have an added inspiration for preparing technical papers for presentation at meetings as a result of a prize-paper competition announced at the June 7 meeting by *Ernest Lamoreaux*.

Mr. Lamoreaux, who has the distinction of being the branch's only honorary life member of the Supreme Society of the A.E.S., announced that by the time the fall term begins, he will have completed formulation of a plan under which the author of the paper pronounced the best read before the Los Angeles Branch during the 1943-44 fiscal year will be awarded a gold medal donated personally by Mr. Lamoreaux. Award of the Lamoreaux Medal will be made at the last meeting in 1944, preceding adjournment for the summer, and the papers will be judged by a committee to be named by the donor of the award.

Secretary *Carroll McLaren* was instructed to send a telegram expressing Los Angeles Branch's wishes for a successful session to the Supreme Society which opened its 31st annual convention at Buffalo on the day the branch held its monthly meeting.

The membership voted to continue the practice of previous years of holding an annual branch picnic. City Park, Montebello, Calif., was chosen as the site and Sunday, July 25, as the date. *Stanley Rynkofs* was named Picnic Committee Chairman, with *Ed Wells*, *John Merigold* and *James ApRoberts* assisting. Fifty dollars was appropriated for expenses. Chairman Rynkofs announced the committee would consider a suggestion for offering defense stamps as prizes in the track and field events, in place of the cash prizes given in previous years to such contest winners.

The transfer of *John Wiseman* from Grand Rapids Branch to membership in Los Angeles Branch was approved. Mr. Wiseman formerly was foreman of the *Grand Rapids Plating Co.*, Grand Rapids, Mich., and now occupies a similar position with the *Faith Plating Co.*, 7041 Santa Monica Blvd., Hollywood, Calif.

The resignations of *R. K. Solivan* and *Karl F. Webber*, who are no longer connected with the plating industry, were received and referred to the Board of Managers for disposition.

The meeting was of unusual interest because of the variety of subjects introduced during a lengthy open-forum discussion which featured the educational period.

Frank Merigold, operator of a silver and gold plating shop in Los Angeles, precipitated a prolonged discussion when he passed around for inspection a small gold-plated unit of a microphone, one of the parts of a government contract he is working on at present.

Mr. Merigold said he was faced with the problem of the gold plate failing to stand up under a required government acid test. He explained he is able to plate the parts to withstand the acid for about 25 minutes, but said that thereafter the acid starts to work the plate loose. He said he plates 1½ minutes, scratch brushes and plates again.

The membership agreed early that porosity of the metal, which permits the acid to seep below the plate and eventually work it off, was the fundamental cause of Merigold's trouble. Various solutions were offered. It was suggested he try closing the porous condition with copper. To this proposal, Mr. Merigold retorted that he could not give it too much copper because dimensional changes in the part might result. He explained he had tried flash copper, followed by nickel plate and topped off with gold.

Acid copper followed by burnishing was suggested as a means of eliminating porosity. One member suggested 0.0002" copper, followed by burnishing, which, he stated, would not result in dimensional changes in the part.

Another interesting debate developed on the subject of embrittlement of metals and how to avoid it, with *Robert Gripp*, *Frank Bunker*, *Donald Bedwell*, and others offering a number of suggestions. The subject arose when someone told of the difficulty he was having working on small spring parts, some of which cracked after passing through the solution.

To the question of what can be done to increase the throwing power of a cadmium solution consisting of 3½ ounces of cadmium metal and 11½ ounces of cyanide, operated at room temperature, with one to three volts, the consensus of opinion was that the cyanide content should be increased to a ratio of 4 to 1, or from 11½ ounces to 14 ounces. It was also suggested that a test be made to see if the solution has too much carbonate.

The membership extended a hearty welcome to *Bruno H. Schindler*, whose busy schedule of work in defense plants has prevented him from attending an A.E.S. meeting for more than a year.

Obituaries

Edwin M. Baker

Edwin Myron Baker, professor of chemical engineering at the University of Michigan, died on May 26th in New York, as a result of a heart attack which he suffered on May 1 while serving as consulting engineer for Houdaille Hershey Company, a position he held for 24 years.

Professor Baker was known particularly for his research in electroplating. The paper entitled "The Rate of Saponification in Metal Cleaning—A Preliminary Study," which he prepared together with R. Twyning, was a feature of the Sixth Educational Session of The American Electroplaters' Society Annual Convention in Buffalo held in June. Professor Baker was a member of the American Institute of Chemical Engineers, the American Electroplaters' Society, the American Society of Testing Materials, the Society for the Promotion of Engineering Education, the American Association of University Professors, the American Chemical Society and The Electrochemical Society.

He also belonged to several honorary societies—Tau Beta Pi, Phi Kappa Phi, Sigma Xi, Phi Lambda Upsilon and Iota Alpha. Since 1934, he had been financial adviser to the chemical fraternity, Alpha Chi Sigma. He also was a member of the University of Michigan Club of Ann Arbor and the Research Club on Campus.

Born in Toledo, Ohio, February 21, 1893, he received his early education in New York schools, in Hyattsville, Maryland and in Washington, D. C. In 1916 he was graduated from Pennsylvania State College with a B.S. degree. For the following two years he worked for the Hooker Electro-Chemical Co. at Niagara Falls, N. Y. In 1920 he married Ruth Lewis of Tonawanda, N. Y.

S. E. Goldsmith

S. E. Goldsmith, advertising and public relations director of Turco Products, Inc., Los Angeles, for many years, passed away in May as a result of a heart attack. The functions of public relations and advertising have been taken over by Harry Rorick.

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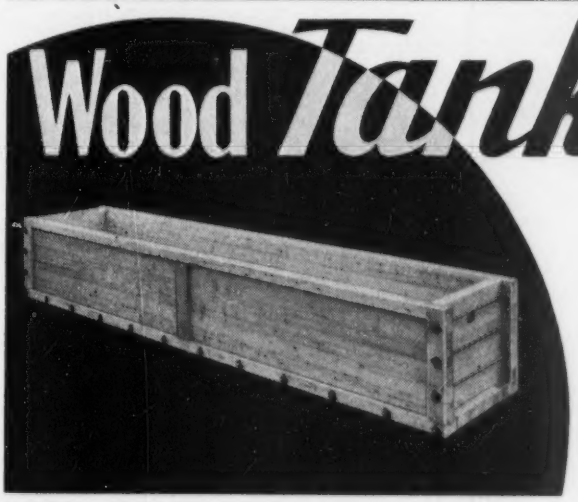

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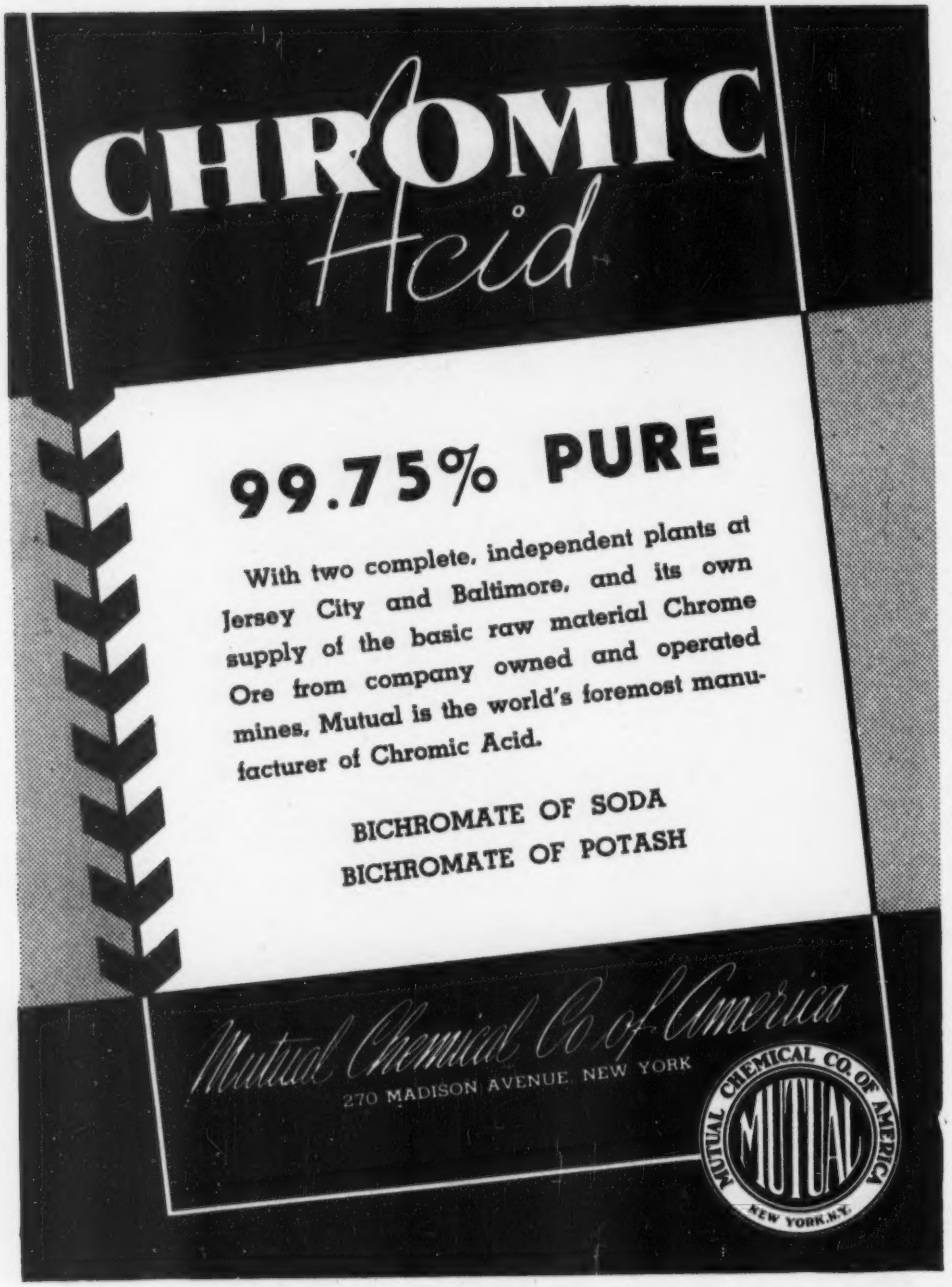
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SAMPLES ON REQUEST

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News from California
By FRED A. HERR

With construction nearing completion on a $13,000,000 addition to the original blackout plane plant of the *Douglas Aircraft Co.* at Long Beach, Calif., *E. R. Williams*, coordinating supervisor of the various plating and polishing rooms in the company's Long Beach, Santa Monica and Inglewood plants, reported the metal finishing division at Long Beach will be assigned considerably more operating space.

While the metal finishing room, 106 by 53 feet in dimension, in which 60 persons are now employed, will not be enlarged in area for operational and production purposes, extra space has been set aside for more effective spacing of the plating and cleaning tanks, sandblast units and equipment used for oiling tubular assemblies with hot linseed oil, and for more storeroom space. The new arrangement, Mr. Williams reported, is expected to result in better productive control. The additions, incidentally, like all other building units in the Long Beach factory, are windowless, the original shop which was opened in the fall of 1941 having been the first blackout plating room in California.

The Douglas Co., according to Mr. Williams, has decided to install a new 2500-gallon zinc tank and a 2500-gallon cadmium tank—when and if the equipment can be obtained. Considerable difficulty has been encountered in getting approval for the new zinc tank, he declared, but prospects appear bright for early arrival of the 2500-gallon cadmium tank.

Three veteran Los Angeles platers were recently discussing the manpower shortage in the metal finishing and machine tool fields. *Robert Gripp* of *Cadmium Nickle Plating Co.*, *Bruno H. Schindler* of *Westcraft Engineering Co.* and *Joseph Sunderhaus* of *Olds Band Instrument Co.*, agreed it was getting to be virtually impossible to find men possessing both intelligence and skill, a rare combination these days, they concluded. They deplored the attitude of indifference which characterizes many of the employees that shops now are compelled to hire by force of circumstance. This factor, they agreed, has developed into a serious problem and is prevented from being seriously reflected in the output of shops only by the vigilance of foremen and inspectors.

With workers at a premium, Mr Gripp pointed out, a "What the heck" attitude is typical of many of the younger men taken on in plating rooms and machine shops. Even the job stabilization program of the War Manpower Commission (metal finishing has been designated as one of the essential industries in Southern California) has not been able to cope with the situation.

"There isn't much a shop operator can do," Mr. Sunderhaus remarked. "If a worker is no good, and shows little aptitude for the work and no particular desire to learn it, there is no point in trying to keep him "frozen" to his plating room job by refusing him a certificate of availability to switch to some other job."

Women, the three men agreed, are showing a finer spirit of cooperation in their efforts to adapt themselves to new jobs. The average woman, Messrs. Gripp, Schindler

and Sunderhaus have found, will try hard. As a result, most women starting from scratch on a new job, will learn quicker and become proficient faster than men.

Mr. Schindler stated that the manpower shortage, combined with the difficulty his firm has had with indifferent male workers, has caused Westcraft Engineering Co. to try out women on lathes and drill presses. The experiment has been successful, he reported. The firm now employes four women on such jobs. On the second day on the job, Mr. Schindler said, the women turned out 10% more work than men who started on the same day.

D. N. Eldred, who was confined to his home for three weeks in May with a serious attack of influenza, is back on the job attending to his chores as manager of the Pacific Division of the R & H Chemical Department of *E. I. du Pont de Nemours & Co., Inc.*, El Monte, Calif.

Mr. Eldred is completing his 25th year with the company. He started when the present establishment was still operated by R & H Chemical Co. and remained when the firm was taken over by du Pont. Mr. Eldred began offering technical service to platers and advice on zinc and other problems about six years ago as a sideline to his other duties. Technical service to the plating industry, particularly on matters pertaining to zinc, is now a full-time job, for which he has the assistance of *F. C. Colburn*, a sales engineer.

Southern California plating shop operators attest the fact that it is not unusual for Mr. Eldred to strip off his coat and spend an entire night trying to help an operator run down some trouble with a tank, solution, current, or other difficulty.

Robert Gripp, who was on the sidelines for several weeks because of an ankle broken when a copper anode fell on it, has discarded his crutches and has returned to his duties at the *Cadmium Nickle Plating Co.* in Los Angeles.

Staff Sergeant Ernst L. Stricker, wearing on his tunic the stripes of overseas' service in the Army Field Artillery, was a guest at the June 9 meeting of Los Angeles Branch, A.E.S. Sergeant Stricker spent eight months in the South Pacific war zone, much of the time in the Fiji Islands.

Marcus Rynkofs, president, *Liberty Plating Co.*, 525 No. LaBrea Ave., Hollywood, and Stanley, his son and shop superintendent, made a business trip by automobile to Nevada during the first week in June. They included in their itinerary a visit to the Basis Magnesium Plant near Las Vegas.

Carroll Winrod of Berkeley reports opening up extensive chrome deposits on St. Charles Hill in an old gold district west of Downieville, Calif. A government loan has been obtained for further development work and the output is reported to be favorable for early production.

High-grade chrome ore is also reported being trucked from the Oxford mine, operated in the Downieville district by the C. L. Best interests.

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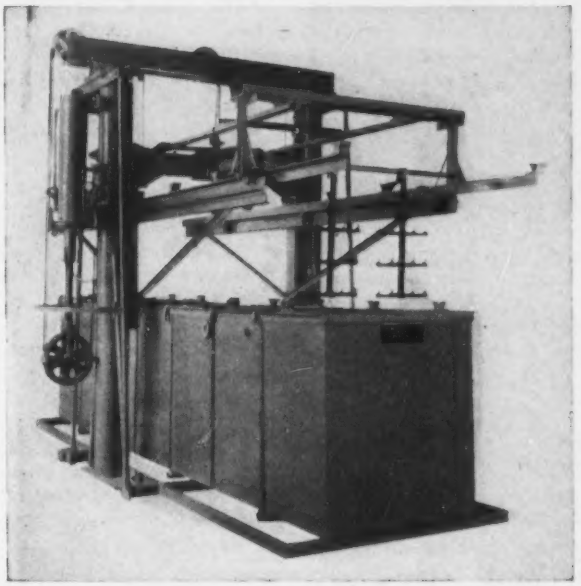

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1910 MAYPOLE AVENUE :-: :-: CHICAGO, ILLINOIS

Frank Bunker of the *L. H. Butcher Co.*, Los Angeles, returned May 26 from a business trip to the Middle West. He stopped off in Chicago for visits to the Buick Aircraft and the Minneapolis-Honeywell plants, and spent an afternoon inspecting the great Chicago plant of the Great Lakes Plating and Japanning Co.

From Chicago Mr. Bunker went to Detroit to attend the two-day sales conference, May 19 and 20, of the Udylite Corporation, for which firm the L. H. Butcher Co. serves as West Coast representative.

The Faith Plating Co., 7141 Santa Monica Blvd., Hollywood, Cal., are now working around the clock—24 hours a day, seven days a week. The company, founded in 1933, moved to its present location in 1936 and are now employing 45 men and 16 women. M. F. Faeth, founder and president, was formerly vice-president and manager of O'Connor-Faeth Plating Co., for five years and for 12 years prior to that, assistant manager of Pacific Enameling and Plating Co.

Bruno H. Schindler, former plating plant superintendent for the *Weiser Manufacturing Co.*, 8635 Otis St., South Gate, Calif., who terminated 18 years' service with that hardware specialty manufacturing firm when its plating activity was discontinued soon after the outbreak of war, is now superintendent of *Westcraft Engineering Co.*, precision tool makers, Slauson Ave. and Hooper St., Los Angeles.

In his present capacity, Mr. Schindler is supervisor of machine tool making. Mr. Schindler styles himself ". . . an ex-machinist from way back," and has found that his many years of concentration on metal finishing while with the Weiser Co. has not dulled his skill as a machinist to any appreciable degree.

Two tuition-free courses in metallurgy were announced by the University of Southern California, Los Angeles, beginning June 10. The night classes are conducted by *George Wyman* and feature instruction in extractive metallurgy of critical metals.

Re-opened in 1942 by *J. H. Lester*, Jackson, Calif., mining operator, after lying idle for 43 years, the Newton mine near Jackson is reported to be developing into a major copper producer. The gossan-capped ledge is reported to range from four to eight feet wide, developments have been carried to a depth of approximately 400 feet, and material sampling three to six per cent copper recently was found in country rock 15 to 25 feet from the main ore body.

News has reached Southern California of the release by the Bureau of Mines of the U. S. Department of Interior of a report on a new process which has been developed whereby a four hundred million ton dolomite deposit near Las Vegas, Nev., can be utilized for the production of many millions of tons of magnesia, a raw material of magnesium, the lightweight metal used extensively in airplane production.

The discovery was characterized in the report as a noted contribution to the department's program of providing needed war materials. Sufficient data are reported to be on hand to enable the bureau to operate a small commercial-scale plant for processing the dolomite, thus paving the way for development of the immense deposit by private interests.

Harry L. Smith has been appointed vice-president and general sales manager of *Kelite Products, Inc.*, Los Angeles, Calif., manufacturers of industrial chemicals for cleaning and processing. Mr. Smith, who has been with Kelite since 1937, formerly covered the entire country as a "trouble shooter," visiting plants where new or difficult cleaning problems were encountered. He returned early in June from an extended visit to Eastern war centers where he and *J. H. Hart*, Kelite Chief Chemist, studied cleaning operations in the aircraft factories.

Bruce Wiswall has been placed in charge of the Engineering Division with the responsibility of providing blueprint and instructon data on cleaning methods developed for special war production needs.

Also announced are the opening of the St. Louis offices to be the headquarters of *M. L. "Marty" Forsberg*, former Los Angeles salesman who is now Midwest Regional Manager for Kelite, and the following appointments: *C. L. Gilmour*, Southern California Regional Manager; *Leon Alexander*, General Manager, Houston, Texas, factory; *Lyle Harbour*, Arizona-New Mexico Regional Manager; *R. E. Medanich*, Northern California Regional Manager; *Ernie Severseu*, North West Regional Manager; *William Van Patten*, Control Chemist, Los Angeles laboratory. Ten new men have been added to the service engineering staff.

Rapid growth of this six and a half year old concern has closely paralleled the increased use of new metals and alloys for which specialized methods of cleaning and processing had to be developed. Kelite makes extensive use of pH control in manufacturing and dispensing its materials.

Kelite now operates two plants in Los Angeles, one for bulk chemicals and one for packaged products, and also has factories in Chicago, Perth Amboy and Houston.

Articles of incorporation have been filed during the past month for the following firms in Southern California:

Allied Metal Corp., Santa Barbara. Directors: *Harold S. Nix*, Alhambra; *Louis Osbourne* and *Ralph C. Raddue*, Santa Barbara.

Santa Rosa Tungsten, Inc., 430 Story Building, Los Angeles. Directors: *George Stahlman, H. R. Golenor* and *Esther Lopez*, all of Los Angeles.

Basic Metals Corp., capital stock, $75,000. Directors: *W. A. Duncan, Mahlon H. Wolff* and *L. M. Fahrney* of Los Angeles.

American Aircraft Parts, Inc., Los Angeles, 2500 shares, no par stock. Directors *B. C. Rose, K. E. Sims* and *M. Marsch*, all of Los Angeles.

Hi-Shear Rivet Tool Co., 539 Pier Ave., Hermosa Beach. *George Seabrook Wing* and *Allan Joseph Kirk.*

The following have filed to engage in business under the firm names indicated:

Aluminum Heat Treating Co., 2441 East Olympic Blvd., Los Angeles. *William W. McCullough.*

Hughes Die Co., 8453 So. Broadway, Los Angeles. *Thompson C. Hughes, Oscar J. Olson* and *A. C. Olson.*

California Die Engineering Co., 1109 So. Delmar St., San Gabriel, Calif., *Howard V.* and *D. G. Moore.*

Aircraft Inspection Laboratory, 800 E. 61st St., Los Angeles. *Hilliard F. Cromer* and *Harold B. Barr.*

ASC Machine Tool Co., 900 Kittyhawk Ave., Los Angeles. *Charles L. Blek*, Inglewood, Calif.

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Business Items

The Magnus Chemical Co., Inc., Garwood, N. J., has announced the appointment of *H. L. Trembicki* as manager of its newly organized Wire Coating Division.

Mr. Trembicki has had a wide range of experience in the metal working and wire drawing industries. He started his business career as foreign representative for a large steel manufacturer.

In the period following, he devoted his time to metal cleaning problems and to the development of lubricants and coatings on wire to eliminate the adverse effects of lime in drawing operations.

During this time, Mr. Trembicki was successful in developing a process for drawing wire without the use of lime—a process which has been adopted by several of the leading wire mills in this country.

As manager of the Wire Coating Division of the Magnus Chemical Company, Mr. Trembicki will specialize in servicing the wire and steel industries with this new process which will also be extended to include deep drawing of steel and other metals.

The Ferbert-Schorndorfer Co., 43 East Ohio St., Cleveland, O., has recently appointed *Edwin B. Hasseld* of Indianapolis as representative for Indiana, it was announced by *David Andrew*, the company's president.

Formerly connected with Sherwin-Williams Co., Mr. Hasseld is well qualified in the industrial paint field. Eighteen years of experience have given him a thorough knowledge of lacquers, enamels, wood finishing and other industrial paint materials.

Plans for a new research laboratory, remote from the present plant of the *Ilg Electric Ventilating Co.*, 2850 North Crawford Ave., Chicago, Ill., have been approved by the Board of Directors, according to a statement released by *John M. Frank*, pres.

The new building is to be constructed west of the present plant. Of one-story, modern construction, it is being specially built to be shake-proof and to a considerable extent sound-proof.

Equipment for the new building will include latest scientific instruments for measuring air, electricity, sound, light and vibration. Since the buildng is of vibration-proof construction, extremely sensitive apparatus is being installed for sound analysis. Stroboscopic equipment will be supplied for checking deflections while equipment is in operation. A separate heating plant will provide steam and hot water for testing steam and hot water unit heaters.

In 1908 *The Manhattan Rubber Mfg. Division* of Raybestos-Manhattan, Inc., was the first industrial plant in the Passaic, N. J., area to set up its own first aid hospital.

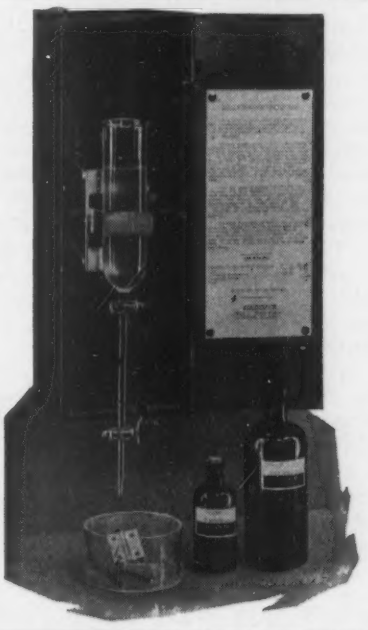
Today, the company's new 14-room hospital is one of the most modern of its kind in New Jersey. It is staffed by a physician, five nurses, a secretary, and a clerk. Equipment is of the latest type and includes examining, treating, operating and recovery facilities.

The rooms of the hospital include a reception hall with waiting facilities, the doctor's consulting room, and a large first aid dressing room with a clerical alcove, supervising nurse's office, and an emergency ambulance entrance. Adjoining this dressing room is a completely equipped operating room and a physiotherapy room where employees are given post-injury care to insure full recovery. This room is equipped with large infra-red apparatus, a short-wave diathermy machine, thermo-reflect heat lamps, two massage or treatment tables, a foot tub bath and a fracture table.

For the medical examination of all new employees, the hospital has an examination and history room equipped with a scale, an eye test machine and record files. This room connects with two individual examining rooms equipped with blood pressure machines, surgical set-ups and examination tables. Also included is an X-ray room and a full size surgical supply sterilizer.

New Manhattan Rubber Hospital.

Manhattan's employees are encouraged to visit the hospital if they sustain even a minor scratch or similar injury to prevent infection. Employees are given periodic physical examinations and the hospital facilities are also available for the treatment of minor non-occupational illness.



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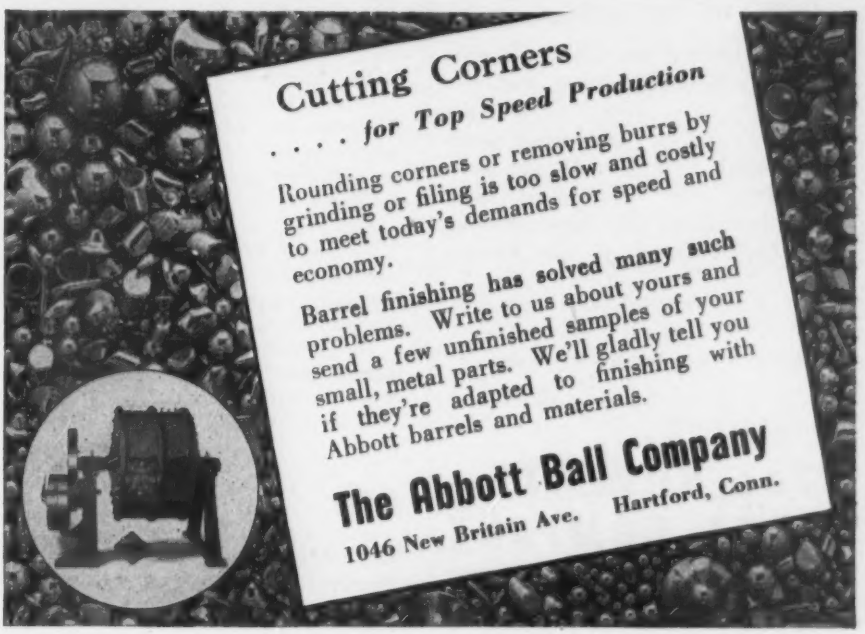
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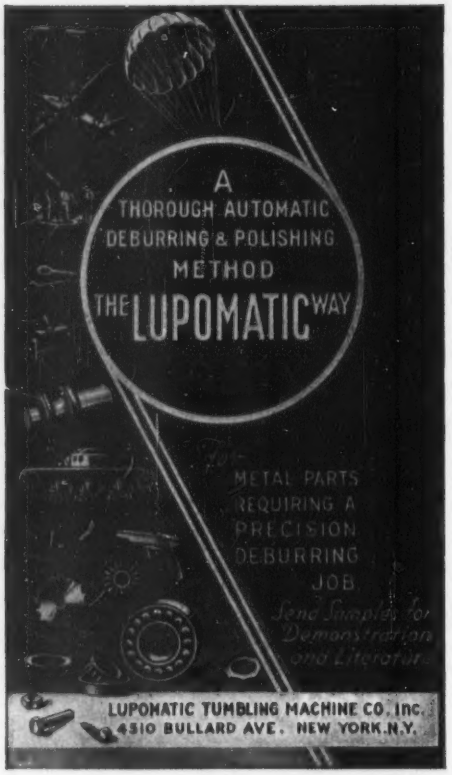

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STRATFORD CONNECTICUT

William P. Drake, recently appointed manager of sales of the *Pennsylvania Salt Manufacturing Co.*, has been placed in charge of the company's sales of acid and alkali-resistant cements and chlorinated organic chemicals, in addition to his former duties as manager of the Pennsalt Cleaner Division.

Mr. Drake started on April 7, 1934 at the Wyandotte plant in the company student training course. After spending several years in the various plants and in the executive offices of the company, Mr. Drake took over the sale of the then new product, Orthosil. At that time Mr. Drake made his headquarters in Detroit. In May of 1939 he was appointed manager of the Pennsalt Cleaner Division, under which were combined Orthosil and other specialized industrial cleaners.

In taking over his new responsibilities, Mr. Drake has made changes in his department in order to serve better the war industries which consume nearly 100% of the products under his supervision.

Albert H. Clem and *Joseph J. Duffy*, formerly in the Detroit and Rochester territories respectively, were brought to Philadelphia to assist Mr. Drake in the Pennsalt Cleaner Division. Both are chemical engineers, Mr. Clem being responsible for technical service to arms plants, while Mr. Duffy is responsible for technical service to the airplane industry. *J. S. Dimon*, formerly the company's local representative in the Philadelphia area, has been given charge of sales and service in the transportation field, while *W. J. Hennessy*, with headquarters in Pittsburgh, is in charge of technical service to the steel industry.

In addition to Messrs. Clem and Duffy, Mr. Drake has assisting him in Philadelphia *Vincent A. Curll*, also a chemical engineer, who has had considerable experience with acid and alkali-resistant cements.

Recent additions to Mr. Drake's department are *Edward J. McDevitt*, who is now located in St. Louis, and *John C. Hampson*, formerly in the company's General Laboratories Division, who has been transferred to the Pennsalt Cleaner Division with headquarters in Indianapolis. *W. J. Stoddard*, who formerly covered the Indianapolis territory, is now in the Detroit territory.

Dr. Robert V. Yohe, technical superintendent of the chemical division, *The B. F. Goodrich Co.*, Akron, O., has been named plant manager of the government synthetic rubber plant operated by B. F. Goodrich in Kentucky.

Dr. Yohe, in the rubber industry since 1931, joined B. F. Goodrich as a research chemist and has held a number of important research and production positions in various divisions of the company.

He succeeds *J. W. Frasche* who has been named plant manager at another government synthetic plant in Texas which will also be operated by B. F. Goodrich.

Chester F. Conner, manager distributor sales, Industrial Products Division, *The B. F. Goodrich Co.*, Akron, O., has been appointed to the staff of advisers on mechanical rubber goods in the Office of Rubber Director, War Production Board, Washington, D. C.

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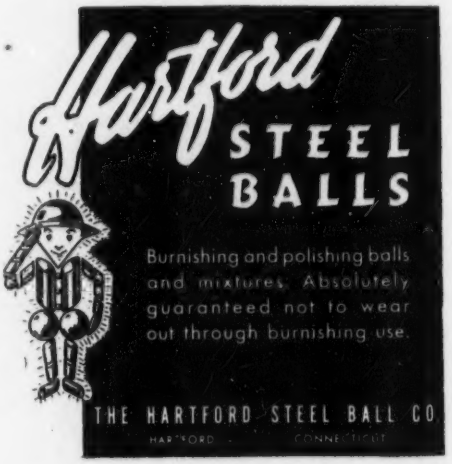
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About nine months ago arrangements were made for classes in blue print reading, shop mathematics and measurements, machine tool operation, etc., by the *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., manufacturers of electroplating equipment and supplies. It was set up as an eight-week course, classes to be held from 7 to 10 P.M. on Mondays, Tuesdays and Wednesdays and from 7 to 10 P.M. every other Thursday.

The classes were under the general supervision of the New Jersey State Supervisor of Vocational Education. *W. J. Murray*, Director for Middlesex County, and *Mr. Townsend* of the Vocational School, New Brunswick, N. J., *Arthur Friedman* of the engineering department and *Harvey Hunt* of the laboratory were designated as instructors. The Wednesday night sessions were conducted by *Joseph Wachter*, superintendent of the machine shop.

The classes were open to members of the factory force and the engineering and drafting departments, who had not previously had opportuity to obtain similar instruction, in order either to qualify them more effectively to perform their present duties or to make them available for upgrading.

The work was entirely voluntary and there were no requirements for admission other than that applicants be employees of the company.

The next phase of the school schedule includes a course in advanced machine tool operation, given by *Joseph Wachter*, and a course in electricity, given by *Clarence Berger*.

For the future, it is planned to go on with more advanced work and to develop new classes as the needs and occasions arise.

A. A. Schwartz, chief development tool engineer of the *Bell Aircraft Co.*, Buffalo, N. Y., was the principal speaker at the monthly dinner meeting of the American Society of Tool Engineers, Los Angeles unit, at 4801 Crenshaw Blvd., Los Angeles, on the night of June 12. Schwartz discussed tool design and metal processing of materials used in tool construction and fabrication.

Purchase of *Quimby Pump Co.*, with plants at Newark and New Brunswick, N. J., by *H. K. Porter Co., Inc.*, Pittsburgh, Pa., has been announced by *T. M. Evans*, president of the Pittsburgh firm.

Established before the turn of the century, Quimby Pump Co., manufactures a full line of pumps, including screw, centrifugal and rotex types. At present the company is also building considerable quantities of pumps for both the Navy and Maritime Commission.

The Quimby plants will be operated as a division of H. K. Porter Co., Inc., a manufacturer of industrial locomotives and chemical processing equipment, Mr. Evans said. The purchase, he added, was made in order to further diversify H. K. Porter Co., Inc.'s line of products.

W. S. McKeon

Wilfred S. McKeon, president and general manager of *Sulphur Products, Inc.*, and better known in the industry as "Mac," could not attend the recent Buffalo Convention of the American Electroplaters' Society because he was confined in West Moreland Hospital, Greensburg, Pa. He is still there as this issue goes to press.

Mac's many friends missed him at this convention, which was one of the very few he has not attended, and those informed of his illness wished him a speedy recovery.

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Quotations furnished promptly upon request.

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Alrose Chemical Co., Cranston, R. I., manufacturers of the "Jetal" blackening process, have announced the appointment of *Jack Hanney* of Grand Rapids, Mich., as their sales representative in the Middle West.

Frederic B. Stevens, Inc., of Detroit, Mich., have opened a branch office at Room 1123, Fidelity Building, 1940 E. Sixth St., Cleveland, O. Telephone: Cherry 6165.

Foundry supply and equipment will be handled through the Cleveland office by *Frank J. Balsley* and the other lines by *Charles H. Stoddard.*

Claude B. Schneible, president of the *Claude B. Schneible Co.*, 3951 Lawrence Ave., Chicago, Ill., makers of Schneible Multi-Wash Dust Collector Systems for industry, has announced the following appointments: *C. C. Hermann*, general manager; *L. C. Beers*, sales manager. The appointments have become effective.

Mr. Hermann joined the Schneible organization in 1937 as sales engineer in charge of the Philadelphia office. In 1941 he became chief engineer of the company. Previous to this connection, he had been with the engineering department of John Deere & Co. in the Moline and Waterloo plants. The new general manager is known as a contributor to the trade and engineering press.

Mr. Beers also joined the Schneible Co. in 1937. He was district sales representative in Detroit and in New England before entering the Chicago office as assistant sales manager.

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For a real good polishing job use

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Phosphor Bronze, Bronze Gilding Metal
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For stamping and drawing
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For fuse elements
ZINC WIRE
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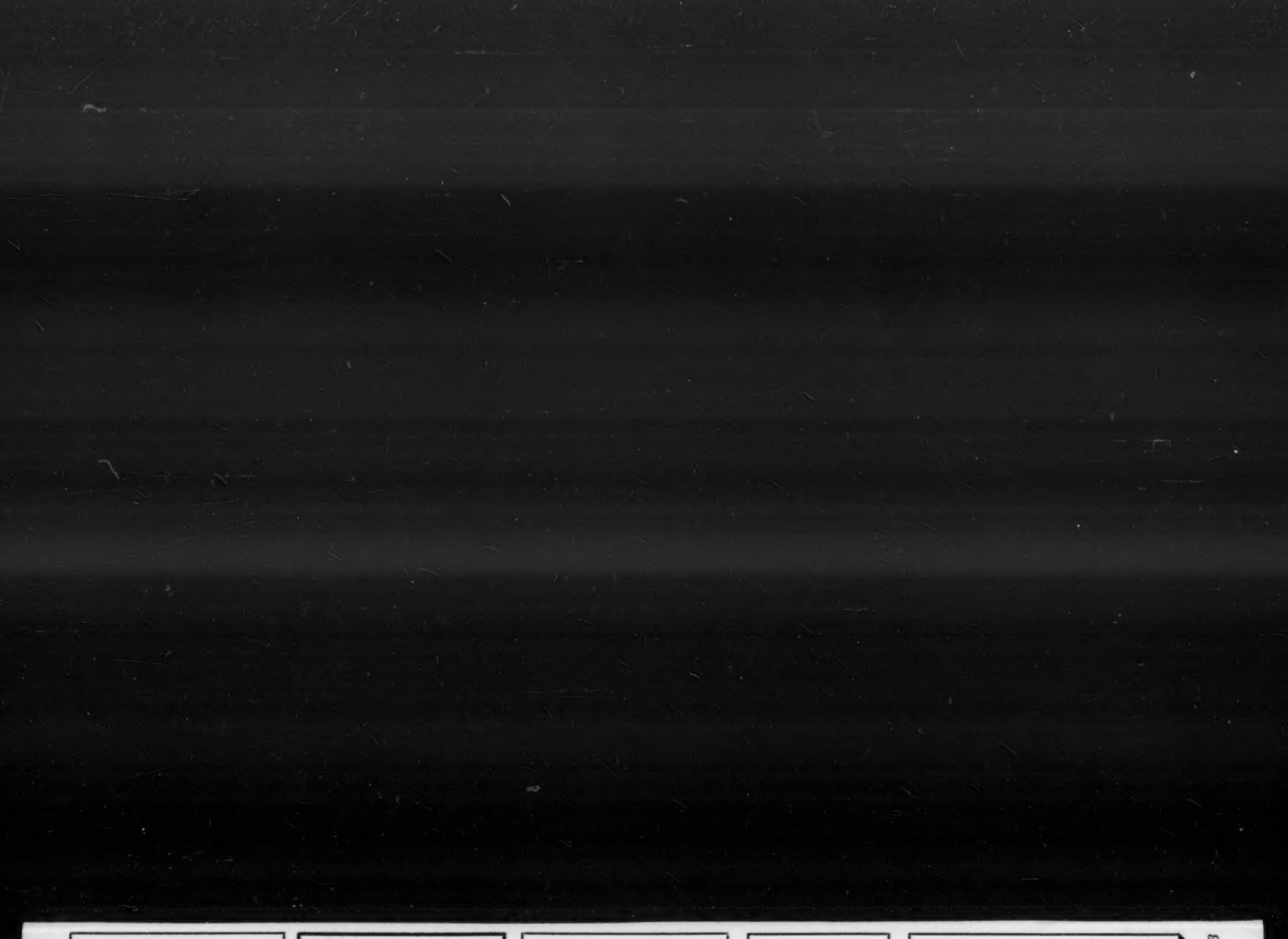
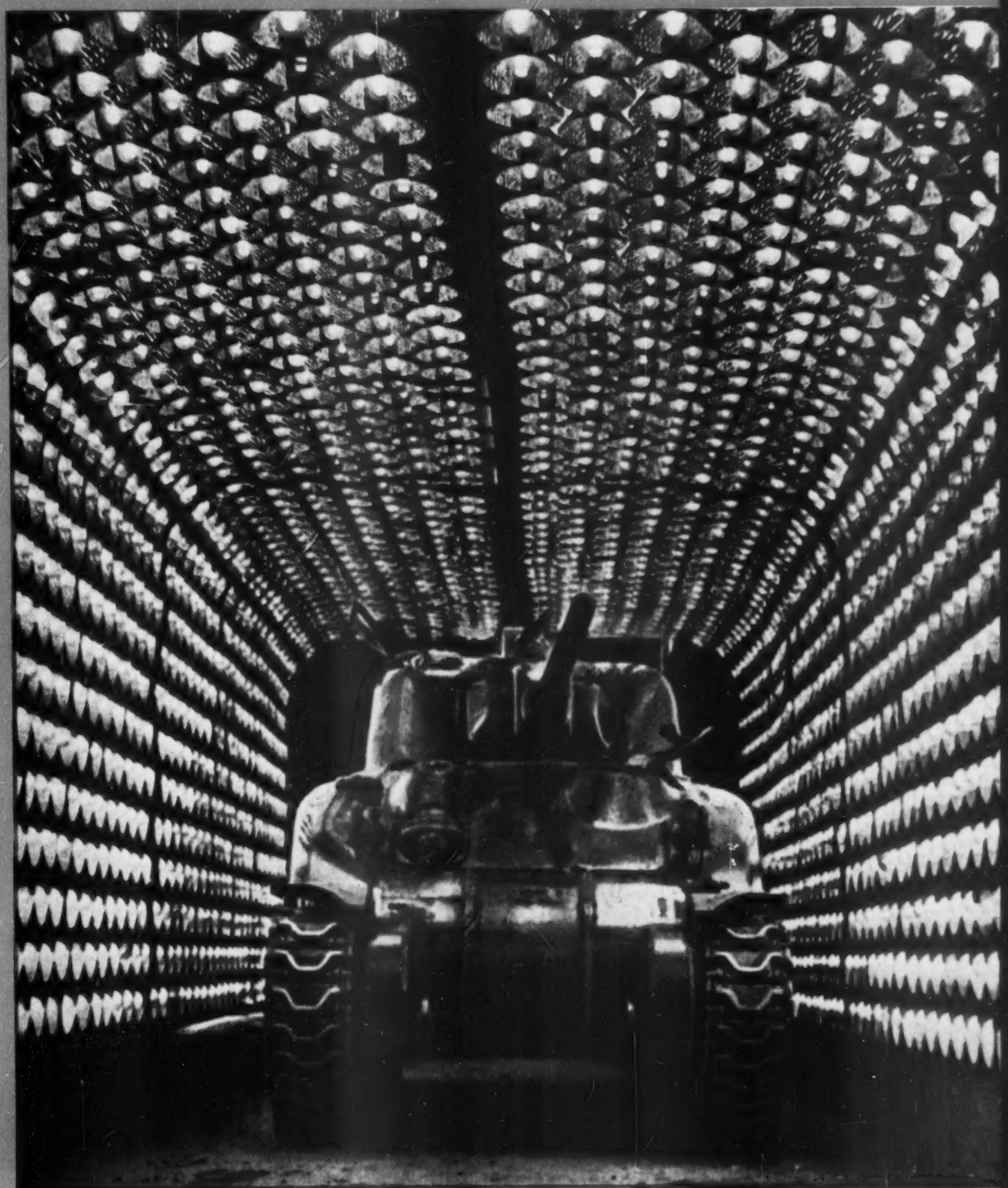


JULY, 1943

ORGANIC FINISHING

SECTION OF METAL FINISHING



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SYNERGISM—meaning forces working together to produce results far greater than both working separately might achieve—has helped win an important military objective. This is the finish so important to the new steel cartridge cases, replacing critical brass.

Leading metals manufacturers were given the job of producing steel cartridge cases which involve a whole new set of manufacturing problems, from drawing the case to finishing it. They called in Zapon, who knew little of cartridge case fabrication from steel, but has a broad background of metal finishing.

Zapon technicians and the manufacturer's men sat down together and studied the problem. The finish must protect inside and outside, against the charge, abrasion, weather all over the world, and other factors. A finishing procedure to fit into the production line was needed.

Formulas were studied. Constant discussions were held. The result was a Zapon steel cartridge case finish exceeding in several respects the Army's rigid requirements. Likewise it was fitted to fast manufacturing methods. Today carload after carload of Zapon finished cases moves to the fronts.

Thus did synergism help solve an important problem and solve it fast because it went far beyond mere co-operation. Our men became partners with the manufacturer's men and each gave the other ideas that might not have been born through co-operation only. Thus does synergism crack new industrial frontiers. Let's talk it over.

ZAPON

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JULY, 1943

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Cover Photograph

A freshly painted tank is dried in four minutes as it passes through a tunnel of infra-red lights. By ordinary methods the paint would require 24 hours to dry.—*Press Assoc., Inc.*

The Paint Chemists

We wish to pay tribute to a group in the finishing industry that is doing an outstanding job in this war. We refer to the paint chemists. They deserve a great amount of credit. They have done and are doing what sometimes seems to be the impossible in formulating finishing materials—and good ones—in spite of material shortages and all the other war-created problems. They have changed from peace time finishes to war finishes with as little disruption and loss of time as we have seen in any industry. This is no mean accomplishment since most war finishes present special problems which must be solved quickly and surely.

Few of us who have not had actual experience in the formulation of finishing materials can appreciate the difficulties involved. For example, finishing materials are complex combinations of resins, oils, gums, pigments, plasticisers, etc., to mention a few of the types of ingredients. Of each of these ingredients there is a wide variety, all with particular advantages and disadvantages. Again, finishing materials must be made to possess a number of properties such as a particular color shade, a certain gloss, good adhesion, resistance to various chemicals and atmospheres, the ability to apply easily under varying conditions, etc. This list could be extended greatly.

Even in normal times, when the choice of raw materials is usually limited only by cost and when time is not as important a factor as it is now, choosing the proper ingredients and correct proportions to make a material with desired characteristics is not a simple task. In times such as these, the job is doubly difficult. However, the paint chemists have shown that they are equal to the occasion and we take off our hats to them and to their knowledge and experience.

L. H. LANGDON, *Publisher* • T. A. TRUMBOUR, *Business Manager*

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VICTORY WRINKLE FINISHES

—*Without CHINAWOOD OIL*

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Because of a shortage of Chinawood oil the use of standard wrinkle finishes has been prohibited by the Government, except for a few special applications.

M&W research has developed a complete line of wrinkle finishes that contain no Chinawood oil but closely resemble our standard Duart wrinkle finishes in all other respects.

They form hard, durable coatings; they cover rough metal surfaces effectively in a single coat; they are applied in regular wrinkle patterns by the same methods; and they are supplied in a full range of colors.

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THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Acetic Esters Under Order M-159 Control General Preefrence Order M-159 which controls all grades of butyl alcohol which are used in the manufacture of *paint and protective coatings*, was amended on May 26, 1943, to place under its control acetic esters such as normal butyl acetate, secondary butyl acetate and isobutyl acetate. In making application for delivery of these commodities, five copies of Form PD-600 must be filled out. Three of these copies must be filed with the War Production Board, Chemicals Division, Washington, D. C. The fourth copy must be sent to the supplier, and the fifth copy should be retained in the applicant's files.

End-Use of Aluminum Pigments Thomas J. Starkie, chief of the Pigments and Colors unit of the Chemicals Division, at a recent meeting of the Aluminum Pigment Manufacturers Industry Advisory Committee of the WPB, made a plea for accuracy in presenting the essentiality of end-uses in applying for allocations under Conservation Order M-1-g which governs *aluminum pigments, paints and other liquids*. Members of the committee revealed that at present there is a scarcity of aluminum foil. For this reason they presented recommendations that action be taken to prevent the remelting of foil.

General Preference Order M-196 Revoked Because there is now an adequate supply of nitrocellulose, which is used for lacquers, the WPB protective Coatings Section announced on May 14, 1943, that the WPB revoked General Preference Order M-196.

Isopropyl Alcohol Allocation Procedure Simplified The allocation procedure governing isopropyl alcohol, which is used for *cleaning compounds, resins, and coatings*, was simplified by General Preference Order M-168, as amended May 18, 1943. Previous to the issuance of this amended order, the producer or supplier had to use Forms PD-600 and PD-601. It is now necessary to use only Form PD-602. Deliveries of 54 gallons or less of isopropyl alcohol to any person during a calendar month continues to be exempt from delivery authorization requirements. Requests for quantities between 54 gallons and 3,500 gallons in any calendar month must be lumped on Form PD-602 under specified end-uses. But requests for more than 3,500 gallons in any calendar month must be listed individually by the supplier on Form PD-602.

Linseed Oil Price Rollback On May 21, 1943, the Office of Price Administration issued RPS No. 53, 1, Amendment 33. This amendment ordered a rollback of three-tenths of a cent on the going prices of linseed oil which is used in the making of paint and varnishes. The basic price in the schedule set up in Amendment No. 33 to Revised Price Schedule No. 53 (Fats and Oils) for Zone 1 is 14.5 cents a pound for raw linseed oil with color value of 11-13; acid value of 4; iodine value of 170 to 190; saponification value of 188-196; specific gravity of .931 to .935, and a viscosity of A. A differential of 2 cents a pound is to be added for Zone 2; 4 cents for Zone 3; 6 cents for Zone 4; 5 cents for Zone 5; 5 cents for Zone 6; 6 cents for Zone 7; 5 cents for Zone 8, and none for Zone 9. Other basic prices for different grades of linseed oil in Zone 1 ranged from 14.5 cents to 20.5 cents.

Methyl Isobutyl Ketone Control Methyl isobutyl ketone, sometimes called "hexone," an alcohol denaturant and a substitute for butyl alcohol as a lacquer solvent, was placed under allocation control by the issuance of Preference Order M-322 on May 25, 1943. Methyl isobutyl ketone was placed under control because of the present shortage of butyl alcohol. To fill certain small orders, suppliers are permitted to furnish users with 54 gallons of this chemical during a calendar month without written authority provided the total quantity does not exceed the amount the supplier is authorized to deliver during that period. Each month suppliers are required to file Form PD-602 to show their proposed deliveries.

Resin Advisory Committee Appointed The WPB announced the appointment of a Natural Resins Industry Advisory Committee which consists of Wells Martin of the WPB; O. G. Ennes, N. Y. C.; George Hauxhurst of S. Winterbourne & Co., N. Y. C.; W. A. Patterson of G. W. S. Patterson Co., N. Y. C.; A Scharwachter of the American Cyanamid & Chemical Co., N. Y. C.; E. H. Winter of H. P. Winter & Co., N. Y. C.; and A. J. Wittenburg of the Stroock & Wittenburg Co., N. Y. C.

Steel Drums The WPB Container Division is urging the observation that the WPB allocates the shipment of new steel shipping drums by manufacturers under Conservation Order M-255. It points out that a preference rating must be assigned before the Containers Division can authorize users to purchase the containers. Users who have a preference rating should make application for authorization to buy new steel drums on Form PD-835. Anyone not operating under CMP or PRP, who does not have a preference rating, must first obtain such rating on Form PD-25F or CMP-4-b. After receiving the preference rating, application for authorization to buy new steel drums must be made on Form PD-835.

Tung Oil Restrictions The War Food Administrator has forbidden the use of tung oil after July 1, 1943 for use as a base for ship paints. He also restricted its usage in two varnishes which were generally used by the Maritime Commission as a base for ship paints. This order was issued because of the growing shortage of imported tung oil.

Zein Under Allocation Control Zein, an alcohol soluble protein which has been found to be useful as a substitute for shellac when combined with rosin, was placed under allocation control by General Preference Order M-320, issued on May 15, 1943. The order provides that no supplier, (producer or distributor) is permitted to deliver zein to any person except as specifically authorized by WPB. An exception to this ruling is the delivery to any person of not more than 100 pounds during a calendar month. Suppliers must use Form PD-602 to apply for delivery authorization.

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with

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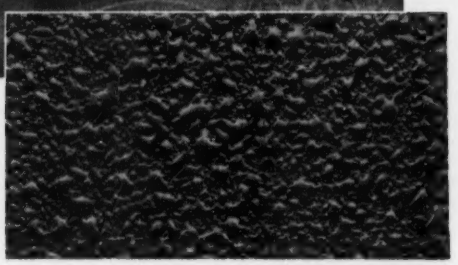
Photo by U. S. Army Signal Corps

THIS new EGYPTIAN rough finish is already in sharp demand for war products and essential civilian items that have metal surfaces requiring a rough finish. Radio sets, instrument panels, fire control and listening devices are "naturals" for PEBBLE-TEX, a tough, durable finish made to stand up under severe exposure.

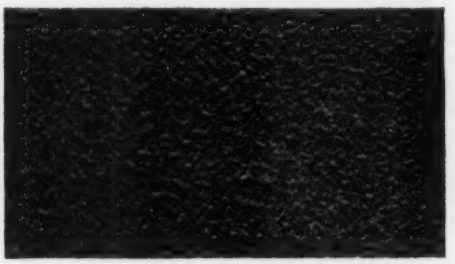
Note these outstanding advantages of PEBBLE-TEX:

1. **Air-drying at 20 minutes. Saves time, manpower and oven space.**
2. **Simple to apply with pressure type spray gun. Varying degrees of texture obtainable from same mix by gun adjustment.**
3. **PEBBLE-TEX pattern in one coat. For full metal protection use over a primer.**
4. **Comes in a variety of colors.**

Your trial order at drum price will receive prompt attention. Kindly write to Dept. MF



Here are shown actual photographs (unretouched) of panels finished with PEBBLE-TEX. Above shows coarse texture.



This panel shows a finer texture. The size of the pattern is regulated by spray gun adjustment and application technique.

THE EGYPTIAN LACQUER MANUFACTURING CO.
ROCKEFELLER CENTER, NEW YORK, 20, N. Y.

EGYPTIAN FINISHES

EGYPTIAN
Superior FINISHES

Industrial Degreasing Agents

By H. P. QUADLAND

Safety Research Institute, Inc., New York, N. Y.

THE ideal solvent would be one that would degrease rapidly and efficiently in a small space and would be non-flammable, non-explosive, non-toxic, and non-irritating to the human skin. But the "ideal" solvent has never been attained. Therefore, when considering the substitution of one solvent for another, due to wartime restriction, shortages, or other reasons, this fact should be kept in mind. It then becomes necessary to select a cleaning agent on the basis of its effectiveness for the particular degreasing job required; its hazards, such as flammability, explosiveness, and toxicity; equipment needed; availability of supply, and cost.

Although there are many variations in degreasing, the principal methods of cleaning are: (1) use of alkaline compounds which exert a saponifying or emulsifying action on the grease or oil; (2) cleaning with chlorinated hydrocarbon solvents, and (3) use of petroleum solvents such as gasoline and naphtha.

Alkaline Compounds

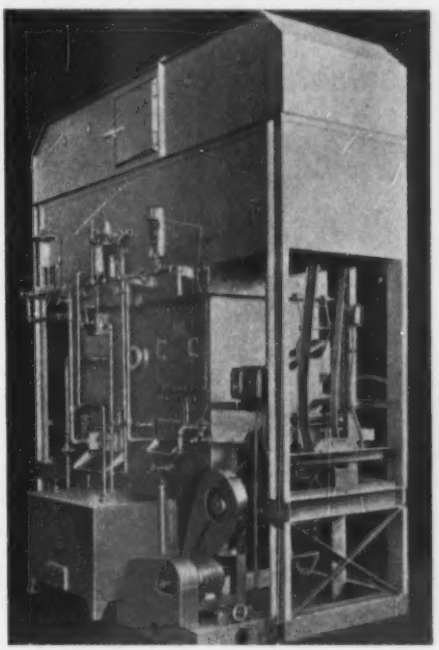
This method involves the use of cleaning agents such as sodium carbonate, caustic soda, tri-sodium phosphate, sodium sesquicarbonate, sodium silicate, and numerous commercial preparations which contain one or more of these substances. For some purposes, various mixtures of alkalis are used, such as sodium cyanide, tri-sodium phosphate, and soap chips, for cleaning copper or certain alloys containing copper.

Alkaline cleaning is effective for many metal parts, such as iron and steel castings. The alkali emulsifies oils and greases and the parts are dipped, tumbled, or sprayed often enough to wash them free of foreign matter. Alkaline cleaning is often used for cleaning sheet metal rolling from high speed mills.

Some of the shortcomings of alkaline cleaning are said to be the danger of etching precision parts and, if the washes are not thorough, the leaving of spots or streaks on the metal part. Moreover, alkaline cleaning may be slow and sometimes does not have the penetrating power to cleanse the less accessible corners of certain metal parts.

Chlorinated Solvents

Metal cleaning with chlorinated solvents is one of the latest developments in metal cleaning. This method has been in use for ten or twelve years in this country, although it was used extensively in Europe during the first World War. Its use is growing rapidly and, from the standpoint of effectiveness, it appears to be unequalled for cleaning metal parts, particularly die castings and those made of copper, brass, zinc, etc. In cleaning with chlorinated solvents, the outstanding advantages are rapidity of cleaning, volume cleaning in a small space, simplicity of operation, and suitability for cleaning on a mass production basis. Since the oil or grease is dissolved, no scum is left on the surface of the solvent and when the parts emerge from the degreaser they are dry and free of foreign material. As the equipment is economical of heat and space, this degreasing method is applicable to small as well as large industrial operations.



Vapor spray — Vapor degreaser

The principal chlorinated solvents used in degreasing are trichlorethylene, carbon tetrachloride, and perchlorethylene. All of these liquids are very effective in dissolving oils, greases, waxes, and fats used in machining and other manufacturing operations. The method is to either dip in the liquid, spray, or condense the vapors on the metal parts, or use combinations of these procedures.

There are some problems of corrosion in the use of chlorinated solvents. This subject was discussed by C. F. Dinley in *Metal Finishing*, August, 1942.

Pure trichlorethylene is susceptible to decomposition, liberating hydrochloric acid. This decomposition is stimulated by light, oxygen, and heat. All commercial trichlorethylene, therefore, contains a stabilizer to prevent such decomposition. Another stabilizer is added to commercial trichlorethylene to prevent decomposition induced by certain metals, notably aluminum, magnesium, zinc, and their alloys. The amounts of stabilizers added are small—a fraction of one per cent—and they have no perceptible effect on the physical and chemical action of the degreasing fluid.

In the case of carbon tetrachloride, corrosion may be reduced to a minimum by constructing the equipment of selected metals in the following order: nickel, Monel, 18-8 stainless steel containing 2-4% molybdenum,

lead, tin, well-tinned copper, galvanized iron, and copper.

Petroleum Solvents

Dry cleaning of metals by gasoline and other petroleum solvents met the small need for solvent cleaning in World War I. At present, an entirely new set of conditions is encountered in the fact that the existing war is one of mechanized equipment requiring more rapid metal cleaning on a vast scale.

In this type of cleaning, each part is dipped in successive baths and the cleaning agent easily becomes contaminated. The method is slow and not always efficient.

Fire and Explosion Hazards

There is no fire hazard in the use of the alkaline compounds. The chlorinated hydrocarbons, namely, carbon tetrachloride, trichlorethylene, and perchlorethylene are non-flammable, non-explosive, and non-combustible, although trichlorethylene-air mixtures are flammable under certain rather unusual conditions.

Gasoline, naphtha, and other low flash point solvents are, of course, highly flammable and explosive. Many companies, according to the National Safety Council, Industrial Data Sheet D-Gen. 13, do not permit their use for removing oil and grease because:

Properties	*Carbon Tetrachloride* (CCl_4)	*Trichlorethylene* ($CHCl:CCl_2$)	*Perchlorethylene* ($CCl_2:CCl_2$)
Boiling point °F.	170.15	188.8	249.8
°C.	76.75	87.1	121.0
Specific gravity (at 25°C.)	1.589	1.461	1.618
Lb. per gallon (at 25°C.)	13.22	12.16	13.46
Freezing point °F.	—23.0	—86.0	—22.4
°C.	—9.4	—122.0	—8.3
Flash point	None	None	None
Flammability	Non-flamm.	Non-flamm.	Non-flamm.
(Underwriters' Laboratories Rating)	Rated 0	Rated 1-2	Rated 0
Vapor density at boiling point sp. gr. (air = 1.00)	5.32	4.53	5.72
Viscosity, centipoises (at 25°C.)	0.88	0.56	0.84

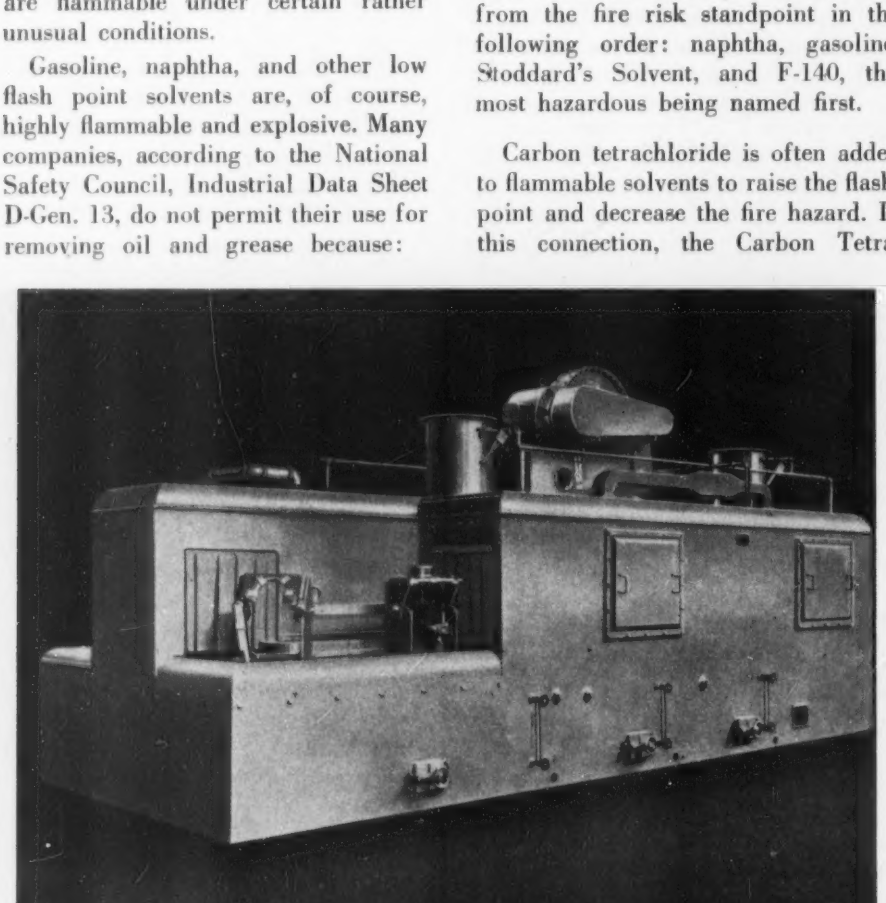
"(a) Such solvents vaporize readily and produce explosive mixtures with air, in some cases in proportion of about 1.4 per cent by volume, and

"(b) the vapors may be ignited by a spark or flame at temperatures considerably below zero Fahrenheit."

Consequently, high flash point petroleum solvents are used. The petroleum solvents may be classified from the fire risk standpoint in the following order: naphtha, gasoline, Stoddard's Solvent, and F-140, the most hazardous being named first.

Carbon tetrachloride is often added to flammable solvents to raise the flash-point and decrease the fire hazard. In this connection, the Carbon Tetrachloride Producers' Technical Committee states: " . . . Differences in rate of evaporation of carbon tetrachloride and the other solvents in the mixture may lead to the development of a flammable mixture during the course of evaporation of a blend which initially was non-flammable. Solvents such as naphtha differ so greatly in their flash points and boiling ranges that it is impossible to state in a general way the proportion of carbon tetrachloride that must be added to them to make them safe from fire and explosion hazard.

"Each solvent mixture must be formulated with the purpose for which it is to be used and with the chemical and physical characteristics of its various ingredients clearly in mind. Where the manufacturer of the mixture is uncertain on any of these points, his safest course is to get the advice of someone with experience in this field."

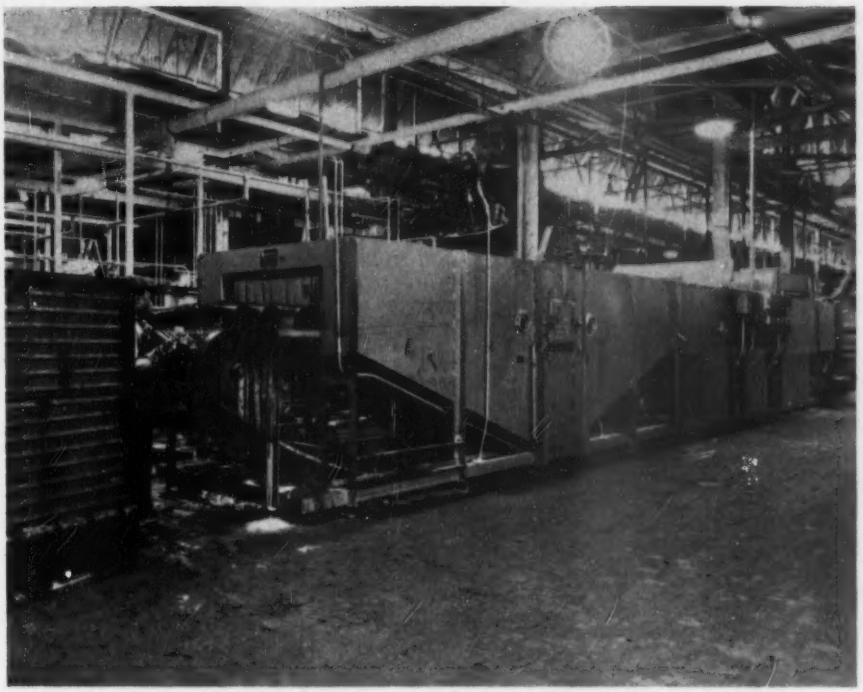


Emulsion or spirits cleaning machine.

Toxicity

Unfortunately, there are no solvents that are entirely without health hazards. The very qualities that make a good solvent appear also to embody a certain amount of hazard. This is true because every substance that dissolves fats will attack bodily organs unless it is used with care.

The chief hazard in connection with the use of alkalis is their action on the skin and clothes. Unlike many corrosive chemicals, sodium carbonate and caustic soda do not give warning of their presence by immediate burning and stinging. Hence, they may cause injury without the handler being immediately aware of it. Workers handling corrosive alkalis should be



Five stage emulsion-alkali cleaning machine.

equipped with goggles, rubber gloves, rubber boots, and rubberized aprons.

The chlorinated solvents are all toxic, if their vapors are breathed in sufficient concentrations. Excessive amounts of chlorinated solvents in the atmosphere are indicated by their odor or by smarting sensations of the eyes and nose. Since their vapors are about five times as heavy as air, recommended ventilation of the workroom is of the down-draft type exhausting the vapors at floor level.

From a health standpoint the petroleum solvents are less hazardous than some of the other solvents. However, Dr. W. F. von Oettingen, Principal Industrial Toxicologist for the U. S. Public Health Service, points out that "the appraisal of hydrocarbons offers considerable difficulties because most of these solvents represent mixtures, sometimes of heterogeneous nature, and because their composition is often incompletely known. Certain solvents such as benzine, gasoline, and solvent naphtha may vary with regard to their chemical composition according to the source from which they are obtained and therefore may vary also with respect to their injurious action." Dr. von Oettingen suggests that chemical analysis be made in order to detect possible noxious components.

Just as they are classified from the fire risk standpoint, the petroleum solvents may be classified as to toxicity in the following order: naphtha, gasoline, Stoddard's Solvent, and F-140, the most toxic being named first.

Availability

In using all of these degreasing methods, concerns engaged in war work are, of course, assured of adequate supplies, while the supply is improving for other users. Caustic soda, for instance, is freely available.

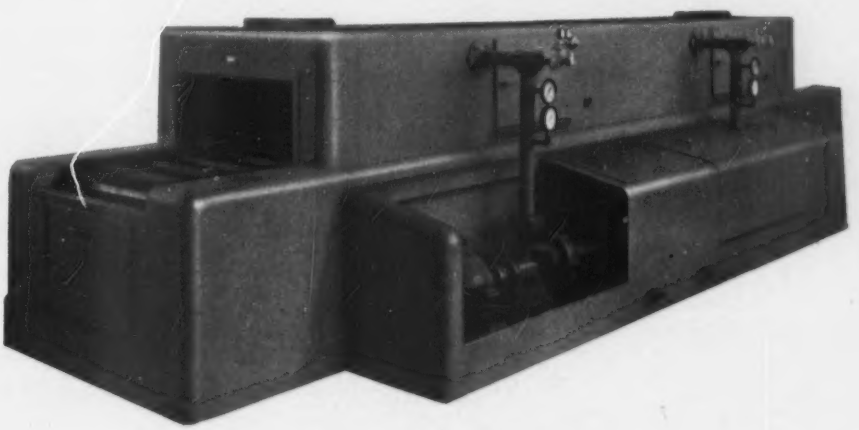
With respect to the chlorinated solvents, the supply runs: carbon tetrachloride, trichlorethylene, and perchlorethylene, with the last two named having the same war-time restrictions and carbon tetrachloride being more plentiful. The supply of these three solvents has improved as the war has progressed. As of January 9, 1943, General Preference Order M-41 was amended to provide that users of carbon tetrachloride in classification B2 —which relates, among other uses, to degreasing machines especially designed to use such solvents at or near their boiling point—may receive 100 per cent of their monthly consumption during the twelve-month base period ending September 30, 1941. Relative to supplies of trichlorethylene and perchlorethylene, a recent War Production Board directive provides that a manufacturer of these solvents can sell to B2 users when the inventory of the solvent manufacturer is in excess of 500,000 pounds.

At present, users of the petroleum solvents appear to have no difficulty in obtaining necessary supplies other than delay, in some sections, due to the transportation problem.

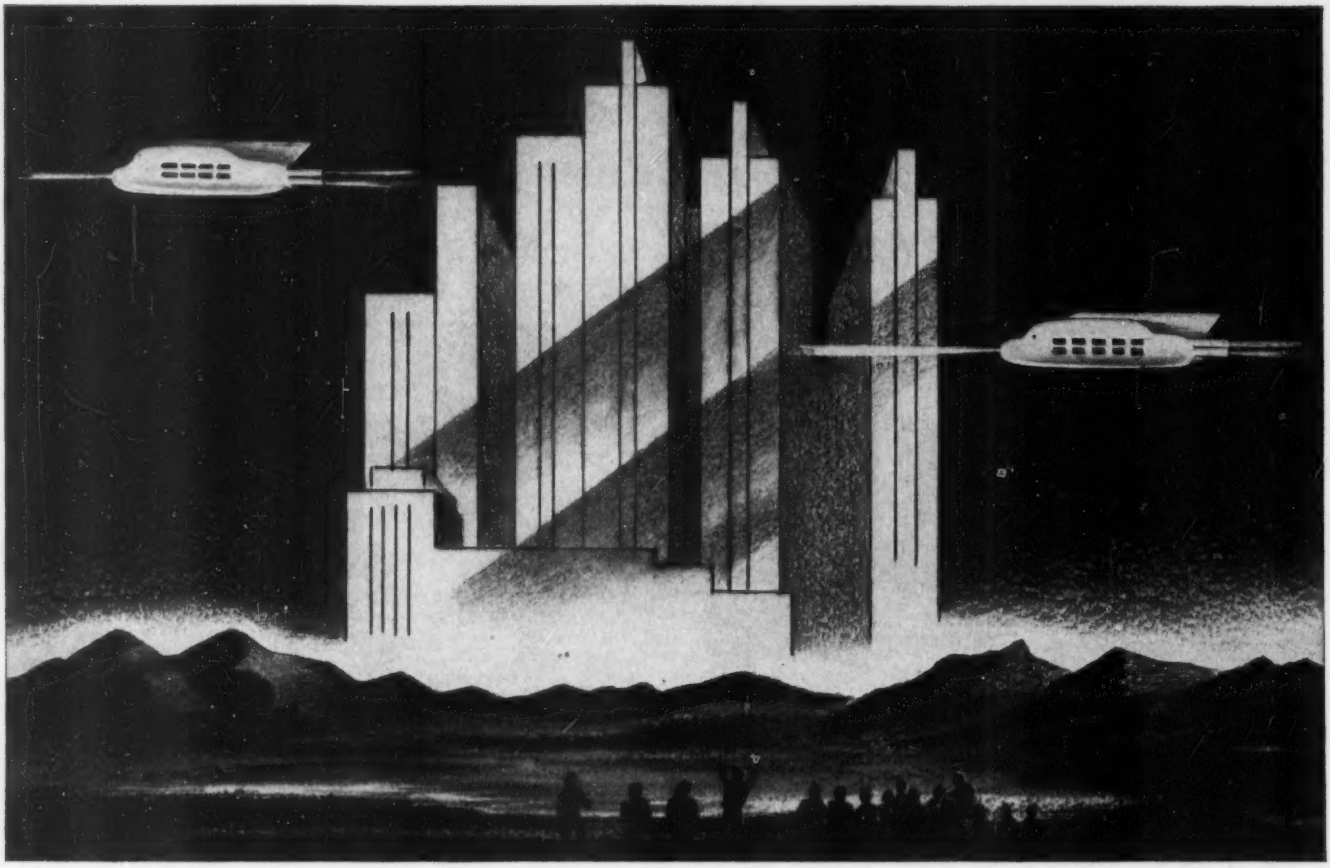
Costs

It is, of course, impossible to tell which method the individual operator can use at the lowest cost. On the whole, the alkaline compounds represent the lowest cost for supplies. In the case of the chlorinated solvents, the liquid is easily recovered and may be used over and over again, so that a higher original material cost may not always represent a higher operating cost.

(Illustrations courtesy of P. C. Mahon Co., Magnus Chemical Co., and Detroit Rex Products Co.)



Alkali cleaning machine.



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Conservation of Linseed Oil in Paints

By EUGENE F. HICKSON

U. S. Department of Commerce, National Bureau of Standards
Washington, D. C.

The following information on conservation of linseed oil is from Letter Circular LC-717, recently issued by the National Bureau of Standards. Data given on the use of bodied linseed oil, reduced amounts of raw linseed oil, etc., will be of special interest to users of paints based on this important material.—Ed.

THE most widely used drying oil in the paint industry is linseed oil. About 79 million gallons of linseed oil were consumed in 1940, and during 1941 the consumption rose to 109 million gallons, of which 75 to 80 per cent was used in the paint and varnish industry. While exact figures are not yet available, the quantity consumed in 1942 will be higher than that used in 1940. Nearly all the linseed oil used in the United States is manufactured there, but in 1940 more than one-third of the 31 million bushels of flaxseed required was imported, mainly from Argentina. Under present conditions practically no flaxseed is imported from South America. At the same time, there have been new demands for the oil, in part to meet the needs of our allies, and in part to replace other imported oils such as tung (China wood oil) and perilla oils that were used previously. Under these circumstances it is obvious that the use of linseed oil must be curtailed. Conservation Order No. M 71 and Amendments, entitled "Fats and Oils," of the War Production Board, restricts (as of December 17, 1942) the amount of oil that can be used in the paint industry, other than for military purposes, to 70 per cent of the average for 1940-1941.

One way of compensating for the decreased supply of linseed oil in the paint industry is to increase the use of thickened or "bodied" oil. Bodied oil is produced by heating the raw oil to about 300° C. (572° F.) for a few hours. Its viscosity is greater than that of raw oil. For example, a Z-4 bodied oil has a viscosity of about 63 poises as compared with 0.5 poise for the raw oil. A blend of one-third bodied oil (Z-4), one-third unthickened oil, and one-third thinner and drier, all by weight, has a consistency about equal to that of the raw oil. The use of such a paint vehicle, containing 67 per cent of oil by weight, represents a considerable saving of linseed oil over the usual vehicle for exterior house paint, which contains about 90 per cent of raw oil and 10 per cent of thinner and drier. However, the saving may be offset in part because a paint made with this vehicle shows some tendency to "pull under the brush," with the result that the painter is apt to apply a somewhat thicker coat than otherwise.

In reformulating a paint previously made with unthickened oil to introduce bodied oil, it is usually necessary for the manufacturer to materially lower the consistency, as measured, for example, by the Stormer viscometer, in order to have the painter apply it at the normal spreading rate. If it becomes necessary to lower the content of pigment in the paint in order to lower its consistency, the reduction should be made in the extending pigments rather than the opaque pigments so that the hiding power of the paint will remain unimpaired.

The conservation of linseed oil through increased use of bodied oil must rest, for the most part, with the manufacturer of prepared paints. In this connection, Circular 649, "Conservation Through Reduction in Oil Content of Exterior House Paints," issued by the National Paint, Varnish and Lacquer Association, Washington, D. C., should be helpful.

Bodied linseed oil mixed with thinner can be used by the painter who prepares his own paints, but there are numerous difficulties, including shortages of labor and of suitable containers, which stand in the way of making this kind of "thinning oil" generally available in place of the customarily used raw oil, particularly for exterior house painting.

A large proportion of the raw linseed oil ordinarily consumed in this country is used by painters in thinning paste, white lead and other pigments, primarily for the painting of exterior wood surfaces. After careful consideration of all the problems involved, particularly in view of the amount of white lead paste and other pigments used throughout the country for *small scale* painting, the Bureau believes that the most practicable way to conserve linseed oil is to alter the formulas customarily used for mixing paint so as to use less oil and more thinner. The resulting paints will contain a larger proportion of pigment and therefore will cost slightly more (perhaps 20 cents per gallon for the finish coat paint) as prepared for use. However, the finish coat of such paints will be whiter and collect less dirt on exposure to the weather than paints mixed according to formulas now in general use. Spreading rates of both present and proposed third coat paints are about the same for each paint. The Bureau believes that the paints will have a satisfactory durability. Since there is no shortage of white lead but a very definite shortage of oil, it seems desirable to suggest the formulas given in Table I. If they are used generally, a saving of oil will result.

The proposed formulas in Table I a. and b. cover both two and three coat painting on new wood. For best results, three coats of paint made on the formulas given in Table I a. are recommended on new wood. However, the formulas given in Table I b. for two coats will give reasonably good service. Obviously, labor, oil and white lead are conserved by using the two-coat formulas. As an alternative, two coats of the proposed third coat paint given in Formula I a. with possibly a slight thinning of the paint with mineral spirits or turpentine for the

TABLE I. CUSTOMARY AND PROPOSED FORMULAS FOR THINNING PASTE WHITE LEAD

a. Painting New Wood Three Coats

Materials	Priming Coat		Second Coat		Third Coat	
	Present	Proposed	Present	Proposed	Present	Proposed
(a)						
Heavy paste white lead (lb.)	100	100	100	100	100	100
Raw linseed oil (gal.)	4	2½	1½	1	3¼	2
Thinner* (gal.)	2¼	2½	1¾	2	¼	⅞
Liquid paint drier (pint)	1	1	1	1	1	1
Total (gal.)	9¼	8	6¼	6	6½	5⅞

b. Painting New Wood Two Coats

Heavy paste white lead (lb.)	100	100	100	100
Raw linseed oil (gal.)	1½	1	3¼	2
Thinner* (gal.)	½	¾	¼	⅞
Spar varnish (gal.)	¾	¾	—	—
Liquid paint drier (pint)	1	1	1	1
Total (gal.)	5¾	5½	6½	5⅞

c. Repainting Wood Two Coats

Heavy paste white lead (lb.)	100	100	100	100
Raw linseed oil (gal.)	2	1¼	3¼	2
Thinner* (gal.)	2	2¼	¼	⅞
Liquid paint drier (pint)	1	1	1	1
Total (gal.)	7	6½	6½	5⅞

*Turpentine or mineral spirits.

(a) For "soft" paste white lead use one quart less of thinner.

TABLE II. CUSTOMARY AND PROPOSED FORMULAS FOR EITHER DRY RED LEAD OR PASTE RED LEAD

Materials	Dry Red Lead		Paste Red Lead	
	Present	Proposed	Present	Proposed
Red lead (lb.)	100	100	100	100
Raw linseed oil (gal.)	3⅛	2	2	1½
Thinner* (gal.)	⅜	¾	⅜	¾
Liquid paint drier (pint)	2½	2	2½	2
Total	5	4⅓	4¾	4⅔

TABLE III. CUSTOMARY AND PROPOSED FORMULAS FOR DRY BLUE LEAD OR PASTE BLUE LEAD

Materials	Dry Blue Lead		Paste Blue Lead	
	Present	Proposed	Present	Proposed
Blue lead (lb.)	100	100	100	100
Raw linseed oil (gal.)	3½	2¾	2¾	1¾
Thinner* (gal.)	¼	1	¼	1
Liquid paint drier (pint)	2	2	2	2
Total	5⅞	5⅞	6¼	6

*Turpentine or mineral spirits.

first coat, will give fairly good service. In following such a practice, it is suggested that each coat of paint be spread at a rate of about 550 to 600 square feet per gallon. Two coats of such paint would be better than three coats of inferior quality paint.

Considerable amounts of raw linseed oil are also used by the painter in the mixing of red-lead and blue-lead paints, particularly for priming iron and steel. Suggested changes in the mixing formulas for these paints are given in Tables II and III. As in the case of the white lead paints, the suggested formulas involve a larger proportion of pigments, of which there is no shortage. Exposure tests made at the Bureau indicate that such paints will be at least as good as those containing less pigment and a larger proportion of oil.

As a further step toward conserving linseed oil in exterior house paint, both Government and civilian painters are reminded that there are commercially available ready-mixed, two-coat, house paints in both mixed pigments and pure white lead. When properly formulated, these two-coat paint systems offer a substantial saving of labor and a slight saving of material, over the usual self-primed, ready-mixed, three-coat paint system. In the Bureau's exposure tests, some of these two-coat paints have been found as durable as the ready-mixed, self-primed, three-coat systems. For war time use, properly formulated, two-coat paint systems are highly recommended. By increasing spreading rates slightly, it is possible to save material at less sacrifice of durability than is involved in similarly cutting down on the usual self-primed paint job. In this connection, the reader is urged to consult a paper entitled "The Two-Coat System of House Painting," by F. L. Browne, Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wis.

For interior painting a choice of ready-mixed materials in which the manufacturer has used bodied oil in one way or another will add to the all-over saving of linseed oil. The paints known as plaster primers and sealers are of this kind. They are available in commercial brands in paint stores throughout the country. When they are used, one finish coat of an eggshell flat paint is generally sufficient. Flat paints contain a high percentage of pigment and a correspondingly low percentage of oil, part of which is likely to be bodied oil. If the painter wishes to mix his own interior paint, flatting oils and lead-mixing oils, are available for the purpose. One hundred pounds of paste white lead mixed with about 3 gallons of flatting oil gives a paint of satisfactory brushing consistency.

There is now in preparation a Federal Specification for a one-coat, flat oil paint for interior painting over porous surfaces such as wall board, wallpaper, and plaster. This paint is designed to be a combination primer, sealer, and finish, all in one coat. It is being used by some of the housing agencies. Its use wherever it is suitable will make another contribution to the conservation of linseed oil. Commercial brands of this kind of paint are available in paint stores.

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Patents

Coating Composition

U. S. Pat. 2,316,274. J. A. Mitchell, assignor to E. I. duPont de Nemours & Co., April 13, 1943. A composition comprising essentially 3 parts nitrocellulose, 5 parts modified rosin, 1.5 parts dibutyl phthalate, 0.5 parts paraffin wax, 0.5 parts benzoyl peroxide and 52 parts cyclohexyl methacrylate.

Vinyl Resin Coating Composition

U. S. Pat. 2,316,323. A. K. Doolittle, assignor to Carbide and Carbon Chemicals Corp., April 13, 1943. A vinyl resin composition essentially comprising a vinyl resin resulting from the conjoint polymerization of a vinyl halide with a vinyl ester of an aliphatic acid, and a solvent having marked compatibility for coal tar hydrocarbons and being adapted to retain its solvent action for the resin in high dilutions with toluene, said solvent comprising an alkoxy acetone.

Paint Composition

U. S. Pat. 2,316,585. L. J. Howlett and W. H. Howlett (Australia), April 13, 1943. A paint composition comprising an intimate mixture of Portland cement, linseed oil, and a suspension medium consisting of magnesium carbonate, said Portland cement and linseed oil being present in the mixture in the ratio of about twenty-four parts cement to about fourteen parts oil, and said cement being maintained in suspension in said mixture by the presence of a relatively small amount of magnesium carbonate intimately dispersed throughout the mixture.

Oil Treating Process

U. S. Pat. 2,317,362. I. M. Colbeth, assignor to The Baker Castor Oil Co., April 27, 1943. The process which comprises reacting glycerides containing hydroxylated fatty acid radicals with a small quantity of boryl pyrosulphate in order to produce unsaturated linkages.

Drying Oil

U. S. Pat. 2,317,663. C. C. Allen and V. E. Haury, assignors to Shell Development Co., April 27, 1943. A drying oil composition comprising an unsaturated ketone condensation product of acetone having at least 12 carbon atoms per molecule in which is dissolved tung oil in the proportion of about 5 to about 80 parts by weight of acetone condensation product to about 95 to about 20 parts of tung oil.

Coating Composition

U. S. Pat. 2,318,780. J. W. Humphrey, assignor to American Viscose Corp., May 11, 1943. A protective coating composition comprising approximately two parts polymerized butyl methacrylate, approximately one part copolymers of vinyl chloride and vinyl acetate and approximately three-fourths part normally solid chlorinated diphenyl.

Paintbrush and Pail Holder

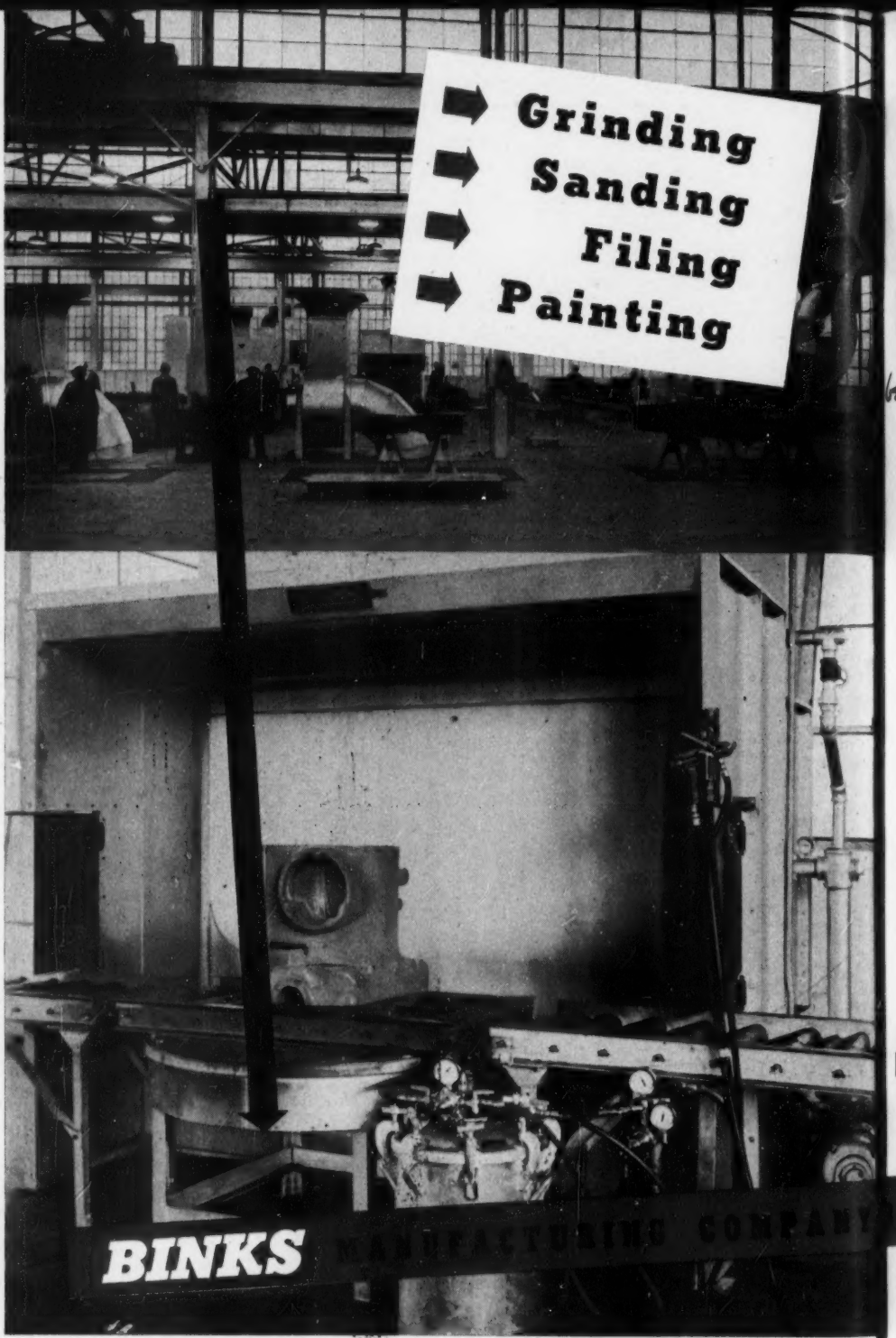
U. S. Pat. 2,318,930. H. J. Dietrich, May 11, 1943. A combination paint brush and pail holder, constructed from several separate pieces of wire fastened together, and comprising an upper circular loop, intersecting perpendicular U-shaped members disposed at right angles to each other, and a lower smaller loop having spaced ends bent to form a substantially inverted V-shaped clip, forming the brush holder, in combination with the adjacent side members of the perpendicular U-shaped members the inner side bar of one of the perpendicular U-shaped members extending above the upper circular loop and bent to form a clip adapted to encircle or embrace the rung of a ladder.

Oil Modified Alkyd Resin

U. S. Pat. 2,319,022. W. A. Waldie, assignor to New Wrinkle, Inc., May 11, 1943. A process for making an oil modified alkyd resin, including the steps of simultaneously reacting castor oil, glycerin and sodium acetate at a temperature of substantially 525°F., cooling the mixture to about 300°F., adding polycarboxylic acids, reheating to about 450°F. and holding the mixture at 450°F. for about 30 minutes.

Overspray Recovery

U. S. Pat. 2,319,082. J. W. Nestor, assignor to E. I. duPont de Nemours and Co.,



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May 11, 1943. An apparatus for collecting the overspray in the form of substantially dry paint particles which comprises a spray booth, means for spraying a coating composition, means for producing a current of air over the object being sprayed, and means for passing it through an exhaust vent, a conductor connected to a source of high voltage direct current, and a series of electrostatically charged baffles on which the overspray solids are collected.

Sheet Coating Machine

U. S. Pat. 2,319,476. D. Ray, May 18, 1943. In an apparatus for coating sheet material with protective coatings, an applicator comprising a tubular member provided with a longitudinally extending slot having substantially parallel walls, said slot forming an applicating port defined by edge portions, a gradually curving surface on said tubular member leading to the front edge portion of said slot, said tubular member being provided with a re-entrant curved surface adjacent to the rear edge portion of said slot, said re-entrant curved surface being parallel to said slot but spaced therefrom whereby said rear edge portion is rendered narrow and is adapted to act as a smoothing knife edge, a rotary valve in said tubular member, said valve being adapted to open and close said applicating port, means for moving sheet material along a line of travel past said port, and means operated by sheets of material advancing toward said port for actuating said rotary valve to open said port.

Coating Composition

U. S. Pat. 2,319,507. W. Krumbhaar, May 18, 1943. In a method of producing oil-containing surface coatings of low viscosity which dry with the characteristics of wood or oiticica oil but without their wrinkling tendencies comprising esterifying a non-wrinkling, gas-proof heat treated monoglyceride of a component selected from the group consisting of elaeostearic acid and the mixed fatty acids of wood and oiticica oils produced by heating at a temperature above 240° C. but below that which would undesirably affect the monoglyceride in the absence of esterifying components, with a non-gelatinizing organic carboxylic acid selected from the group consisting of drying oil monobasic fatty acids and aliphatic and aromatic polybasic organic carboxylic acids.

Coating Composition

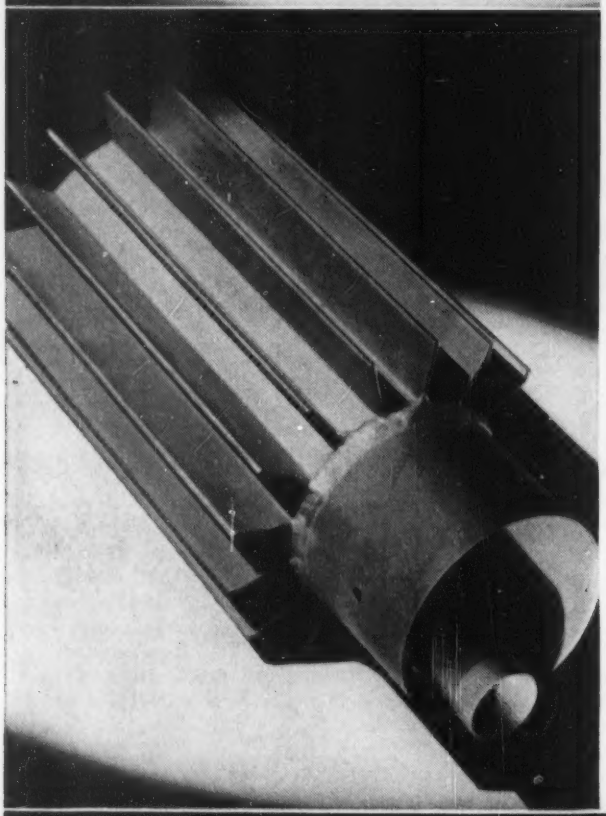
U. S. Pat. 2,319,852. A. K. Doolittle, assignor to Carbide and Carbon Chemicals Corp., May 25, 1943. Process for making a coating composition which comprises dissolving a conjoint polymer of a vinyl halide with a vinyl ester of an aliphatic acid at an elevated temperature in a water-immiscible, organic liquid composition which is a solvent for said vinyl resin at elevated temperatures below its boiling point and which has no greater solvent action for said resin at ordinary temperatures than a partial solvent, the amounts of said vinyl resin and said organic liquid composition being so proportioned that the combination thereof is fluid at said elevated temperatures and substantially immobile at said ordinary temperatures; and thereafter emulsifying the hot solution of the vinyl resin in water containing an emulsifying agent and forming an emulsion in which said solution is the disperse phase; cooling the emulsion and causing the disperse phase to gel without coalescence, and forming a stable suspension in water of particles of a gel which is immobile on mechanical agitation and which is composed of said vinyl resin colloidally combined with said organic liquid.

Crystalline Coating

U. S. Pat. 2,319,886. R. V. Sandstrom, May 25, 1943. A process which comprises mixing the reaction product of rubber with a reagent from the group consisting of chlorostannic acid and a halide of an amphoteric metal, toluol, mineral spirits and cyclohexyl para-toluene sulfonamide, the amount of said mineral spirits being sufficient to render its drying time longer than said toluol, applying said mixture to a surface, and evaporating said solvents whereby said cyclohexyl para-toluene sulfonamide is crystallized prior to the complete evaporation of said mineral spirits.

Coating Composition

U. S. Pat. 2,321,303. E. H. McArdle, assignor to Standard Oil Development Co., June 8, 1943. A coating composition comprising a drying oil, and 30 to 50% of a mixture of branched chain paraffinic hydrocarbons boiling between 300° and 400° F., having an A. P. I. gravity of 53 to 70° and an aniline point between 160° and 195° F.



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The Importance of Phosphate Treatment and Paint in Rustproofing

By GEORGE H. PIMBLEY

General Superintendent, International Rustproof Corp., Cleveland, Ohio

IN the midst of the difficulties that beset the finishing industry we sometimes steal a few moments to think about what the situation will be in peace time. Such contemplation must convince us that the industry will be under the necessity of constantly improving standards of quality and performance. Otherwise, the individual concern will fall behind its competitors and the industry as a whole will lose out to other methods of surface treatment. An array of new and improved raw materials and processes will be available to the finishing industry but a similar crop will also be available to competing industries. Therefore, it is wise for the finishing industry to devote much thought to improvement of products and processes and particularly to a program of education as to the conditions of application such as the proper preparation of surfaces to receive finishing materials.

The general functions of a finish are to ornament and to protect the surface on which it is applied. In the case of iron and steel, the more important of these two functions is protection against rusting. The ornamental value is also important in many instances but the indispensable requirement is that corrosion be prevented as far as possible.

This article will be concerned primarily with iron and steel objects of commerce, in sizes and shapes that permit treatment in hot phosphate baths. We shall, therefore, use the term for corrosion that is customarily applied to iron and steel, that is, "rusting." We shall also use the word "paint" as a general term to cover all types of organic finishes including lacquers, enamels, paints, etc.

According to the most generally accepted theory, rusting is an electrochemical process. Conditions favorable to this process are readily afforded by most steels inasmuch as they are not pure substances of perfectly uniform structure. On the contrary, ordinary open hearth steel contains small

George H. Pimbley

amounts of carbon, silicon, sulphur, phosphorus, etc. These substances are in various states of combination with the iron and, furthermore, vary as to physical structure. It is readily apparent that this condition is ideal for the interplay of electrical potentials whenever water or water vapor is present.

Nearly all substances are soluble in water to some extent and although the amount of solution may be very small, it is enough to initiate and support rusting under certain conditions. The solubility of any substance is often increased if the water contains traces of gases, salts, or acids. Substances differ as to solution pressure. Thus, a spot of comparatively pure iron will dissolve more readily than a crystal of iron carbide which may be nearby. These minute amounts of solutions being formed give rise to small electric currents which pass from one point to another on the surface. This condition produces many of the effects of hydrolysis. Thus, iron dissolving from a point on the surface will form ferrous hydroxide which precipitates and is changed to iron oxide in the presence of air. This is the familiar reddish-brown substance which is called rust.

What is it that paint can do to prevent this electro-chemical process of rusting? It can exclude oxygen and moisture, both of which are essential to rusting. Therefore, shut out the oxygen and the moisture by means of a paint film and there will be no rusting as long as the film remains intact. Unfortunately, the matter is not as simple as that. Not every paint will do this. For example, an ordinary linseed oil paint has many good qualities but it also has many shortcomings. It does not exclude oxygen and moisture completely and it is not tough and hard enough to withstand any great amount of abrasion.

To prevent rusting by means of paint we must exclude air and water as completely as possible, make the paint sufficiently hard and durable to withstand abrasion, provide and maintain a firm bond to the surface to which the paint is applied, and then supplement these measures with whatever else is necessary to stop electrochemical change on the surface of the metal.

Oils and Resins

Paint formulators have resorted to many expedients to accomplish these objects and have, to a very large degree, been successful in working out suitable formulas for many varying protection problems. Oils more resistant to moisture than linseed have been employed, the outstanding one being China Wood oil. Synthetic oils and various processes of cooking oils so as to render them more impervious to water have been developed. The necessity of more than one coat of paint has long been recognized and the various coats of multiple coat finishing systems are formulated to supplement and reinforce each other. Pigments and vehicles are selected and combined so that a modern painting system usually represents the best possible distribution of the various materials.

Alkyd synthetics are particularly useful in the vehicles of metal protecting paints because of their good adhesion and flexibility. Phenolic res-

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ins are especially desirable for use in anti-rust paints, particularly in the primer, and in conjunction with China Wood oil or the more recent synthetic oils that behave similarly to China Wood. A plausible explanation for this is advanced by one of the leading manufacturers of phenolics who states that the great effectiveness of phenolic resins against rusting is due to their resistance to alkali. The theory is that iron in contact with moisture has an alkaline reaction which causes formation of soap with the oil of the paint vehicle. Sufficient moisture is believed to penetrate through paint films to cause this reaction. Such a soap lies between the metal and the paint and causes it to lose adhesion with consequent easy peeling of the paint. Phenolic resins are not attacked by alkalis and therefore do not form soaps that are soluble in water. Hence, the resin remains unaltered and firmly bonded to the surface. The greater the proportion of phenolic resin in primer vehicles, the more effective they are in this respect. Therefore, "shorter" phenolic vehicles are better for anti-rust purposes than the "longer" vehicles. Phenolic resins are in themselves sufficiently flexible so that even short vehicles made from them are not brittle.

Zinc Chromate Pigment

One of the most important ingredients employed in the formulation of metal primers is zinc chromate yellow pigment. This practice is based upon the inhibitive effect of the CrO_3 ion. This group is present in such substances as potassium dichromate, lead chromate, and zinc chromate yellow, the latter being a double salt comprising zinc chromate and potassium dichromate. The rust inhibiting action of chromates depends upon their solution in water whereby the CrO_3 group is set free. The solubility of normal lead chromate, known as medium chrome yellow, is very limited. Hence, its inhibiting action is almost nil. However, medium and lemon chrome yellows are of value because of their property of forming tight, compact films. Orange (basic lead) chromate is more effective and the decidedly basic type known as scarlet lead chromate is very good. Zinc chromate yellow is the outstanding representative of this type of pigment because the potassium dichromate seems to be but loosely bound so that a very appreciable amount of the CrO_3 group is set free by the water that penetrates through even the best of paint films.

It can be appreciated that zinc chromate is a very valuable constituent of paints that must stand frequent or constant wetting. Incidentally, it must be observed here that water may exert such a dissolving effect upon the zinc chromate as to cause pits and blistering in the paint film. Therefore, such paints should have sufficient proportions of such vehicles and pigments as are comparatively impervious to water in addition to the chromate pigment. In other words, the zinc chromate in a primer cannot be depended upon to do the whole job of rust prevention. It should be considered only as a valuable constituent to be used in conjunction with other suitable materials, all working together to do the job.

Notwithstanding the fact that considerable success in shutting out air and moisture is attained by paint formulations of the above nature, fully satisfactory results are not achieved by any paint alone. This is particularly

(*Continued on page* 477)

№ 170 TYPE DEOXIDINE

For GREATER EFFICIENCY

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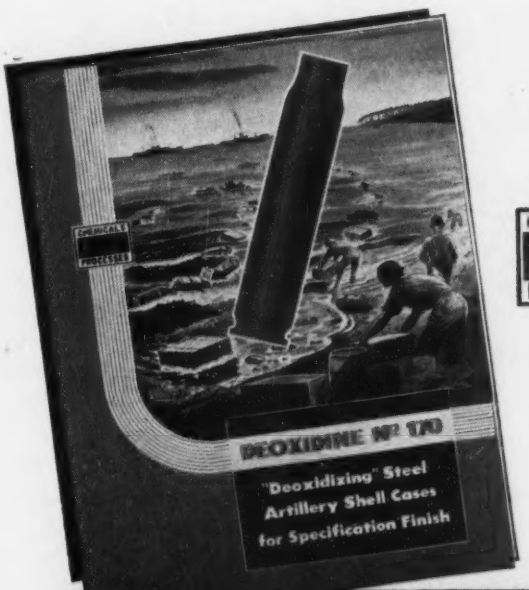
DEOXIDINE #170, admirably suited to the processing of steel shell cases, is but one of a number of grades of ACP acid cleaners. The immersion process in which it is used is adaptable to the cleaning of many other ordnance or marine parts. Other grades of DEOXIDINE are available for brush or spray processes where these are indicated for expediting production.

DEOXIDINE #170 is a chemical that removes light oil, annealing scale and eradicates rust and rusters, producing a clean, minutely-etched, paint-receptive surface. The rusters, even though invisible, are destroyed, eliminating the possibility of defects developing beneath the protective finish. DEOXIDINE does not produce a coating on the cleaned surface which on shell cases, for example, might crack in crimping and in obturation and ruin the protection of the final finish.

DEOXIDINE meets U.S. Ordnance Department requirements for its efficiency in removing rust and neutralizing rust producers before protective finishes are applied.



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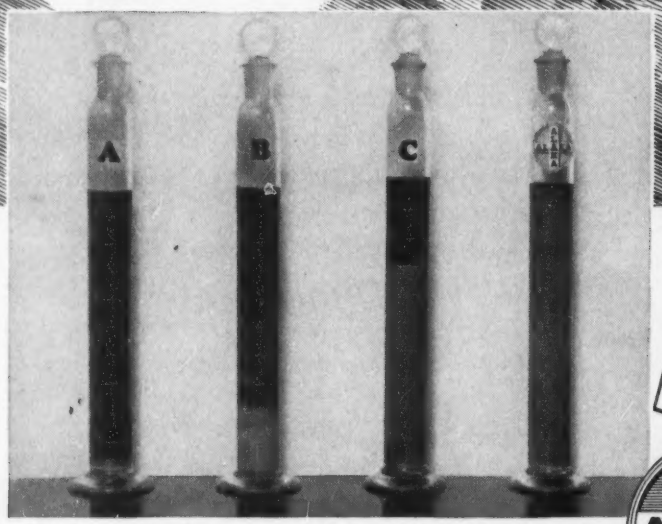

This is a Settling Test. 4 recognized Specification Camouflage Cellulose Nitrate Lacquers, including ALAKA, were all measured and placed in these identical glass graduates at the same time. Note almost total lack of settling of ALAKA.

14105-B
U. S. ARMY AIR CORPS
SPECIFICATION 14105-B
December 17th, 1942
Superseding Specification 14105-A Sept. 10, 1942
LACQUER
CELLULOSE NITRATE
CAMOUFLAGE

ALAKA

Extra Performance

1 DOES YOUR CAMOUFLAGE LACQUER SETTLE BADLY?
Most materials of this type settle badly... some more than others. ALAKA settles too . . . but very little . . . and when it does, it readily stirs into suspension again.

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Many materials of this type chalk excessively. ALAKA chalks too . . . but only to a very minor degree.

3 DOES YOUR CAMOUFLAGE LACQUER HOLD ITS SPECIFIED NON-SPECULAR GLOSS?
ALAKA meets the specification non-specular gloss when manufactured, reaches the user with that specified gloss and retains its specified gloss regardless of the time of storage before use.

4 DOES YOUR CAMOUFLAGE LACQUER LIFT?
ALAKA has no tendency to lift, crack, peel, or to show surface irregularities, regardless of the time which elapses between the application of the Zinc Chromate Primer and the application of the finish coats, when properly applied and when ample drying time is allowed between coats.

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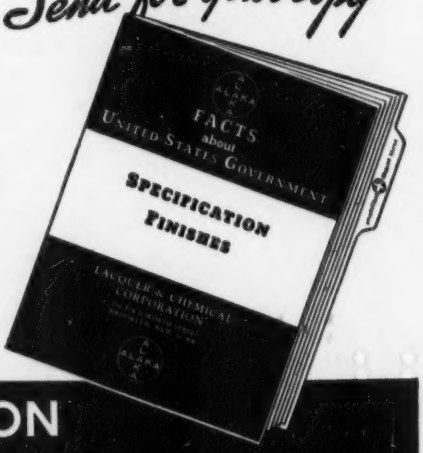

LACQUER & CHEMICAL CORPORATION
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(*Continued from page* 474)

true of articles of commerce which must withstand severe conditions, such as arms and accoutrements for the armed forces, household appliances such as washing machines, refrigerators, etc., automobile fenders and accessories, tools and small parts, etc. In fact, every iron or steel object which is handled considerably or which is subject to abrasion or any kind of severe usage, should have a greater measure of protection than can possibly be afforded by any ordinary commercial system of paints, varnishes, synthetics, or lacquers applied to unprepared metal.

Cleaning

The first step to be taken in supplementing the usual organic coatings is thorough cleaning of the surface. A surprisingly large amount of paint is applied every day to inadequately cleaned iron and steel surfaces with the result that the paint is separated from the metal surface by a layer of oil, grease, perspiration stains, dirt, rust, mill scale, etc. A good bond between paint and metal cannot be obtained under such conditions. The paint is functioning under a handicap and may crack, blister, or peel.

Cleaning by means of solvent washes such as kerosene, mineral spirits, gasoline, or proprietary solvent mixtures is often used. Simple soaking or swabbing with solvents does some good and certainly is much better than no cleaning at all. A further step along this line is vapor degreasing, which is quite effective in those instances where a grease or oil soluble in hot solvent vapor is the principal impurity to be removed. However, vapor degreasing does not remove rust or dirt smudges nor does it act on scale or certain contaminations resulting from drawing compounds which have gone through heat treatments.

A very common cleaning method is immersion in a hot solution of a mild alkaline cleaner. Such a cleaner should not be much more alkaline than a strong soap, should contain suitable detergents and a good wetting agent, and should be used at a concentration of about four ounces per gallon of water. After immersion in the alkaline cleaner, the surface must be well rinsed with clean water and thoroughly and quickly dried. The alkaline cleaner frees the surface from greases, oils, and smudges but has no effect on rust or scale. It is more effective than vapor degreasing in removing drawing compound contaminations. A combination of solvent cleaning or vapor degreasing and an alkaline dip is often very effective, the solvent removing the greater amount of oil and grease so that the alkaline cleaner can remove the balance along with the dirt smudges that are no longer cemented on by grease. If it is possible to do some swabbing, rubbing, or agitating, so much the better. Many small objects are cleaned in washing machines with alkaline cleaners and sometimes with abrasives such as sand.

Mill scale, rust, and certain hard scums formed by drawing compounds subjected to heat treatments cannot be removed by any of the above methods and must be pickled off with sulfuric acid or other pickling agent. Here again there is danger of stimulating new rust if the pickling residues are not thoroughly rinsed away or neutralized in some manner. In fact, the tendency to stimulate fresh rusting as a result of pickling is so great that it is well to avoid pickling as much as possible. In many cases a good tight coat of mill scale does not necessarily have to be removed for good painting results, especially when the surface is given one of the phosphate treatments which will be described in the second portion of this article.

(*To be concluded.*)

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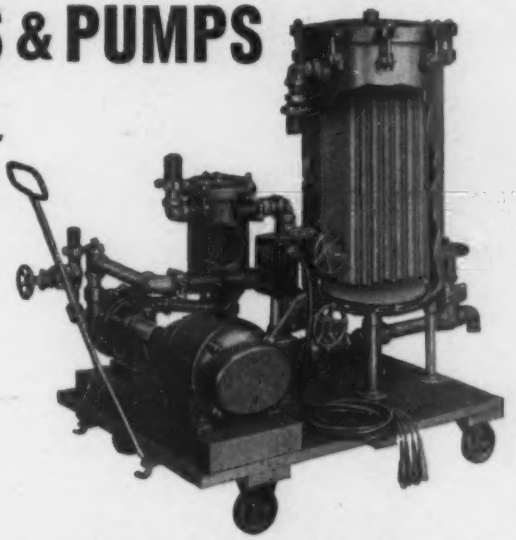

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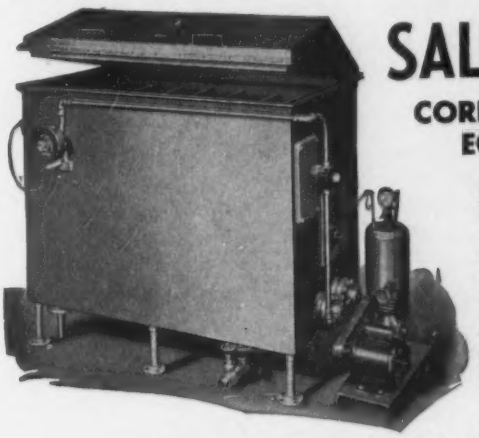

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CORROSION TEST EQUIPMENT

Designed to determine the corrosion resisting qualities of plated or coated metal, alloys, metal parts, organic finishes, etc. This equipment combines necessary features so that Salt Spray tests can be conducted to specifications at Controlled Temperatures to 130 Deg. Fah.

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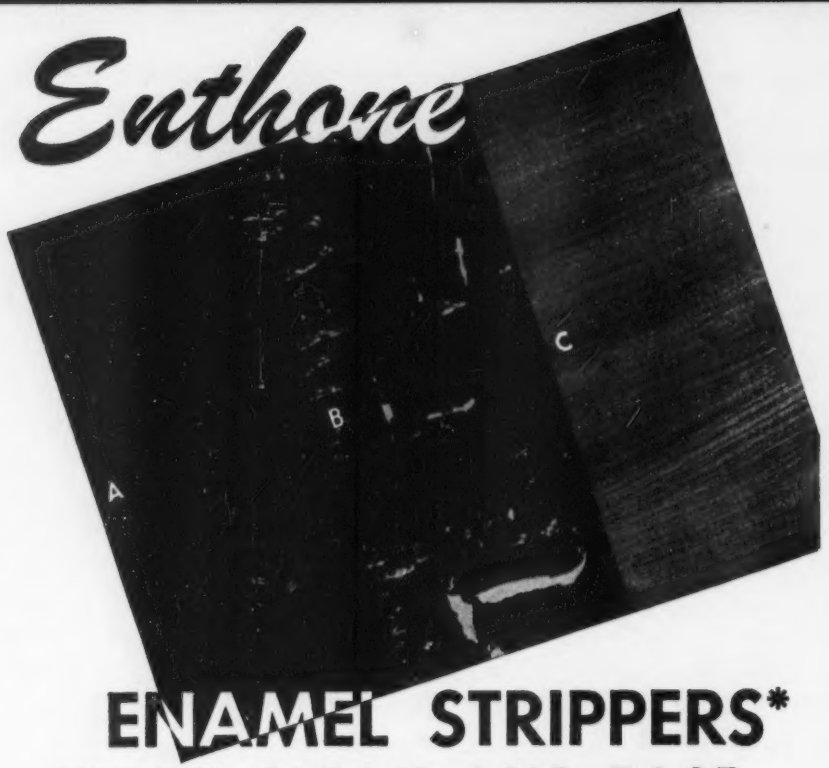

ENAMEL STRIPPERS*
WORK CLEAN AND FAST

The above panel shows how fast Enthone Enamel Strippers go to work.

Panel "A"—*Original enamel of urea-formaldehyde type*
Panel "B"—*After one minute in stripper*
Panel "C"—*After two minutes in stripper*

Notice that the enamel lifts away from the surface, leaving it clean and unattacked.

Enthone Enamel Strippers do not attack any base metal or anodized coatings.

Consult Enthone for stripping synthetics, japans, lacquers.

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12" x 3" to 18" x 6" Buffing Wheels . . 3 to 20 HP., Single and Multiple Speeds

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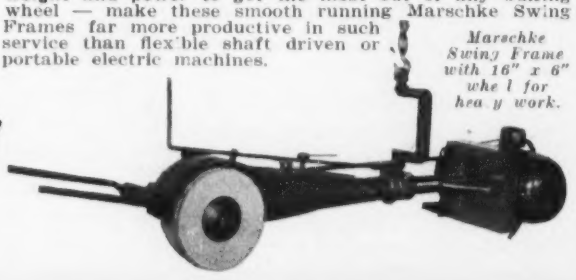
Marschke Swing Frames have proved extra fast and dependable in polishing large or awkwardly shaped surfaces such as kick plates, airplane propellers, locomotive side rods and link motions. Good maneuverability—with the **weight** and **power** to get the most out of any buffing wheel — make these smooth running Marschke Swing Frames far more productive in such service than flexible shaft driven or portable electric machines.

Write for Catalog of bench, pedestal and swing frame Marschke Buffers to Vonnegut Moulder Corp., 1852 Madison Ave., Indianapolis, Ind.



Marschke Swing Frame with 16" x 6" wheel for heavy work.

MARSCHKE QUALITY GRINDERS AND BUFFERS

VONNEGUT MOULDER CORP. INDIANAPOLIS

Manufacturers' Literature

Carbon Filament Lamps for Infra-Red Ray Processes

In Bulletin 78, *North American Electric Lamp Co.*, 1043a Tyler St., (6), St. Louis, Mo., have announced a complete line (in accordance with WPB limitations) of lamps for infra-red ray drying, baking and dehydrating. It includes the inside-silvered, self-reflector type and the bull's-eye, silver type for diffusion and concentration of the ray. The company's lamps are the carbon filament type, which the manufacturers claim yields a greater efficiency in the desirable infra-red ray band with a minimum of visible light.

Insulating Mediums

The Sterling Varnish Co., Dept. OF, 151 Ohio River Blvd., Haysville, Penn., have issued Bulletin 143 entitled *Thermobonds, the New Insulation.*

The bulletin describes ten insulating mediums that have been thoroughly tested in the applications for which they have been produced by subjecting them to excessive heat, heavy overloads, and atmospheres crowded with acid or alkali fumes and abrasive materials. The Thermobonds are produced for application to such units as high speed armatures, high cycle drill and grinder motors, heavy duty motors and transformers, and marine engine magneto coils.

Finish Specification Sheets

Roxalin Flexible Finishes, Dept. OF, Elizabeth, N. J., have recently issued seven supplementary data sheets on their specification finishing materials. These sheets cover non-specular lacquer, quick drying camouflage enamel, water immersible phenolic primer, lusterless olive drab enamel, ammunition lacquers, lusterless drab phenolic enamel, and pigmented cellulose nitrate dope.

Following the plan of previous data sheets on specification materials manufactured by the company, the supplementary sheets list information such as use, thinning, application, drying and baking properties, etc., for each material.

New Protective Coating

A 12-page data bulletin summarizing the properties of Ucilon, a new surface coating material that stands up under most corrosive service conditions, has been issued by *United Chromium, Inc.*, Dept. OF, 51 East 42nd St., New York, N. Y.

Ucilon is formulated with new and improved synthetic resins. It is said to produce tough, flexible coatings that are resistant to organic and inorganic acids, alkalies, salts, alcohol, gasoline, oils, greases and moisture, to have excellent dielectric strength and to be readily applied to wood, metal, concrete and other surfaces by brushing, spraying or dipping. Ucilon F is a special formulation for use in contact with food products.

Finish Specification Folder

Lacquer and Chemical Corp., 214 40th St., Dept. OF, Brooklyn, N. Y., have issued a folder, *Facts about United States Government Specification Finishes.*

This folder is standard file size, attractively printed in red, white and blue. It contains 19 sheets, 15 of which describe in detail the organic finishing materials manufactured by the company to meet specifications of the various branches of the armed service. Four of the sheets are devoted to information on the technical and production facilities, etc., of the company. An interesting feature of the specification sheets is the extra performance data given for many of the materials. These data cover information on performance characteristics and properties which, although not specified, are important in the ease of application, quality of finish, etc.

Folders may be obtained by writing to the manufacturer at the Brooklyn office.

Fire Extinguisher Data

American-LaFrance-Foamite Corp., Dept. OF, Elmira, N. Y., have announced two new fire extinguisher charts, showing the operating characteristics of first aid hand fire extinguishers and wheeled engines.

The charts tabulate the several types of hand fire extinguishers and wheeled engines, and their suitability or otherwise as applied to Class "A," "B" and "C" fires, in accordance with Underwriter's Laboratories classification. For convenience, a Class "D" is added to cover the fire hazards of automobiles, commercial trucks, etc., and a Class "DT" to cover the fire risks pertaining to tank-trucks and trailer-tractors.

Recommendations are also included for alcohol and kindred fire hazards.

The charts give complete data in condensed form as to extinguisher and engine characteristics, methods of operation, capacity, range of stream, etc.

Aircraft Plywood Finish Manual

Publication of the second edition of *Aircraft Plywood and its Finishing Requirements* has been announced by *Ault and Wiborg Corp.*, Dept, OF, 75 Varick St., New York, N. Y. This new edition of 32 pages reports the latest results of research into plywood finishing made by the company and contains recommendations based on the latest available information.

Bound in a convenient loose-leaf folder, the manual includes general information on aircraft plywood finishing and specific data on plywood finishing materials, filler, sealer, etc., manufactured by the company. An outline of finishing systems and a section devoted to technical data on weights of finishes, etc. will be of particular interest to aircraft manufacturers.

Copies of the manual are available to aircraft manufacturers or prime contractors who are directly involved in the production of plywood aircraft and may be obtained by writing to the aeronautical division of the company at the above address.

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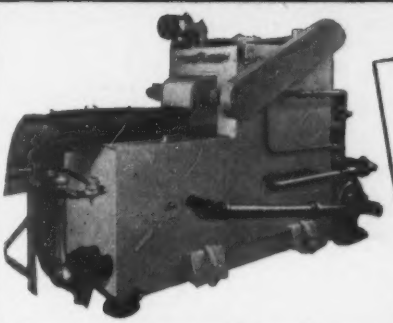

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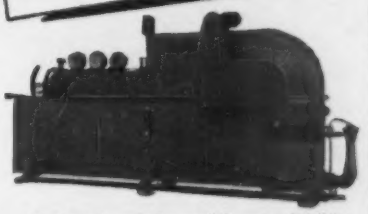
Solvent or Alkali Cleaning
Completely Automatic
One Push-Button Control



Save manpower and speed production with Barry-Wehmiller Metal Cleaners, designed to fit into your production line. Shell cleaner above saved over 50% manpower. Uses inexpensive water and solvent solution.

Automatic unit for applying rust-inhibiting coating to land mines prior to painting. Reduces rejects. Send your special problems to Barry-Wehmiller.

BARRY-WEHMILLER MACHINERY CO., ST. LOUIS, MO.

Have you a Tough metal cleaning problem?

These engineers can help you quickly — at no cost or obligation

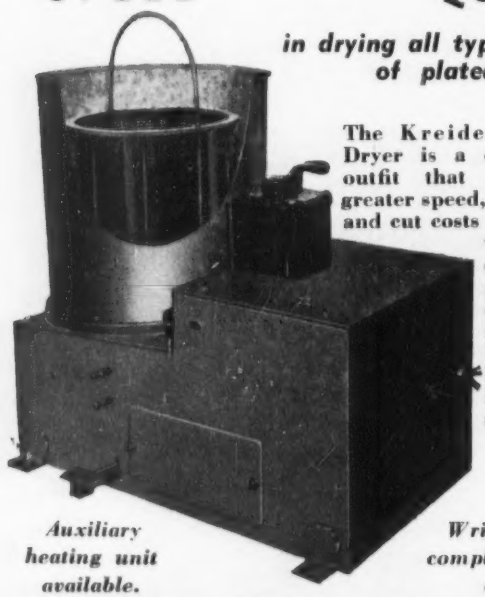
If you want to cut your degreasing costs and speed up your metal-cleaning work—if you have a difficult metal-cleaning job that's giving you trouble—get in touch with us *at once!* There is a lot more to solving a degreasing problem than just buying some new degreasing equipment. Our engineers travel from coast to coast working on every possible type of metal-cleaning operation. They have licked some problems that were called impossible. They are *specialists in degreasing* with many years of experience in that field. They will tackle any job—without a penny of cost or obligation to you—*and we mean just that!* Write *today* telling us what your problem is—and you will get quick action!

PHILLIPS MANUFACTURING COMPANY, 3435 W. Touhy Ave., Chicago, Illinois

Phillips MANUFACTURING COMPANY

Greater **SPEED** • Higher **QUALITY**

in drying all types of plated parts



The Kreider Centrifugal Dryer is a one-man drying outfit that will give you greater speed, improve quality and cut costs of drying plated work and lacquering small parts. All steel construction. ¾ H. P. motor. V-belt drive. Requires minimum floor space.

Auxiliary heating unit available.

Write or wire for complete information and prices.

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"Finishing Metal Products"
By H. R. Simonds. $3.50

"Industrial Electrochemistry"
By Dr. C. L. Mantell. $5.50

"Metal Coloring and Finishing"
By Hugo Krause. $5.00

"Metal Coloring"
By A. H. Hiorns. $2.40

"Protective Coatings for Metals"
By Burns & Schuh. $6.50

"Modern Electroplating"
By Electrochemical Society. $5.50
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"Lacquer and Synthetic Enamel Finishes"
By Ray C. Martin. $5.50

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METAL FINISHING
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NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

New infra-red drying and baking oven.

Infra-Red Ovens

Infra-Red Engineers and Designers, Dept. OF, 1632 East 40th Street, Cleveland, O., announce the Miskella infra-red oven for drying and baking organic finishes, baking armature windings, and similar operations.

According to the manufacturers, these ovens are engineered on a BTU basis and combine the features of the old-type, heavily insulated convection oven and the new infra-red system. They are said to make the operation cost lower and to attain higher temperatures in a shorter time than is now possible with ordinary infra-red equipment.

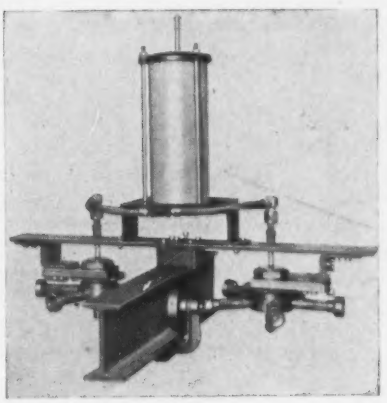
A feature of the ovens is the air circulation system. In addition to the primary air circulation upward within the oven proper, there is a secondary air flow passing between the panels and the exterior cov ering of the oven. Both primary and secondary air meet in the fume duct at the top of the oven and pass out through the chimney. The secondary air flow continues to function even when the primary air flow is cut off.

Miskella ovens are made up of standard sections, insulated with Fiberglas and wired ready for connection, and may be arranged to suit particular shape and size requirements. Installations may be rearranged and new sections added if necessary. Remote control switches, automatic starting and stopping and automatic draft adjustments are included when needed.

Viscosimeter

Technical Products Co., Dept. OF, Memphis, Tenn., offer the new Precision constant temperature Saybolt viscosimeter. This instrument is said to include such features as simplified design, elimination of fire hazard, automatic temperature control accurate to ± 0.05° F, separate removable control box and powerful motor stirrer. It is further stated that use of the instrument will aid the operator by releasing his attention and will promote both speed and accuracy.

Two, four, and six unit models, for 110 or 220 volt a. c. or d. c. current, are available. Viscosity tubes, flasks, thermometers and stopwatch are not included with the viscosimeter and may be purchased separately.



Lubricator

A new device for the automatic application of controlled volumes of lubricants, ranging from oils to heavy fibred greases, to the bearings of conveyor trolley wheels is announced by the *J. N. Fauver Co., Inc.*, Dept. OF, 51 W. Hancock Ave., Detroit, Mich. Its use is said to be particularly important where conveyors pass through kilns, ovens, dryers and other hot zones.

The lubricator is mounted on the trolley rail so that it serves simultaneously the bearings of each pair of wheels, every time they pass this point. It requires no independent power. It is driven by the travel of the conveyor itself, starting and stopping with the motion of the conveyor chain.

As the trolley wheel approaches the lubricator the hub engages the sleeve of one of five pumping units which is thus automatically brought in contact with the wheel bearing. Continued rotation of the lubricator forces the pumping unit inward, delivering a measured quantity of lubricant through the fitting to the wheel bearing. This operation is performed on the bearings of both wheels of a pair at the same time and is repeated on all other wheels as they pass under the lubricator. Reservoirs of 5 or 12 lb. capacity are standard equipment.

Advantages claimed for this method of lubricating trolley wheels include: optional use of hard oil, elimination of drip and consequent work spoilage, automatic operation, reduction of maintenance costs and down time while conveyor is being serviced.

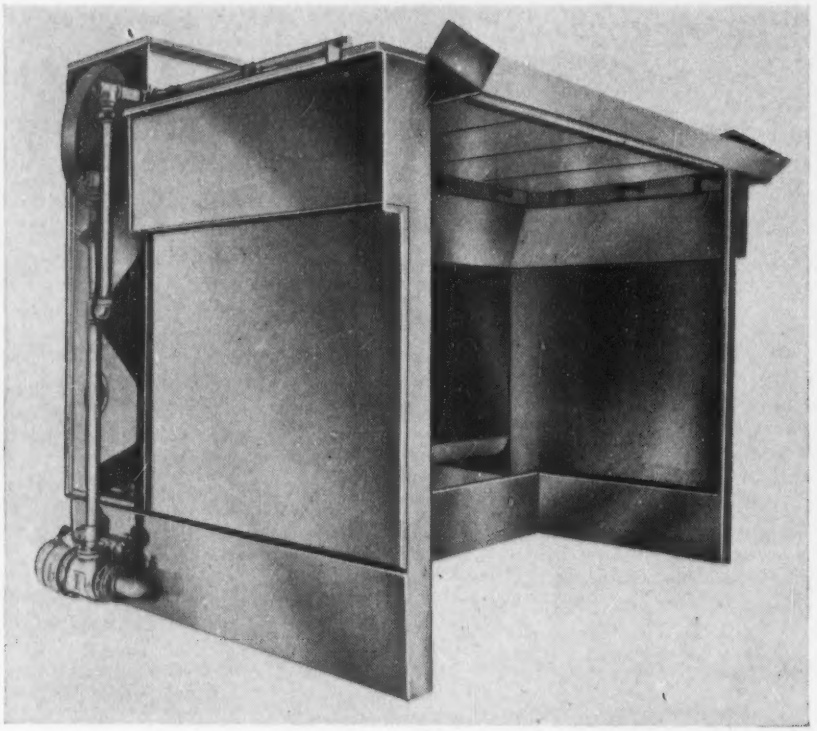
New Mixers

Mixing Equipment Co., Dept. OF, Rochester, N. Y., have announced the addition to their regular line of three new heavy-duty air driven mixers. Two of them are gear reduction models; the third is a larger direct drive model.

The features of these mixers are said to especially adapt them to the mixing of paints, chemicals, high explosives and alcoholic compounds. It is further claimed that the air driven motors used in them cannot be overloaded or burned out and that even when used in the heaviest liquids, they will not stall. The air exhaust from the motor is arranged to keep the motor running cool at all times.

Models of 1 h.p. and ½ h.p. are available. They are equipped with gear reduction drive and adjustable shaft length.

Heavy-duty mixer.



Floor Type Paint Spray Booths For Larger Part Finishing

Illustrated above is Type FLRS-7, a standardized floor-type Aqua-Restor paint spray booth, featuring rear and side water-impingement walls and employing the company's patented super-turbulent chamber.

Developed to meet high-speed, high standard spraying requirements, these booths are said to offer maximum painting speed with greater safeguards for workers and with fire hazards greatly reduced. In operation, the side and rear walls of this paint spray booth are continuously covered with a sheet of water which is completely controlled.

Because the Aqua-Restor method of air cleaning requires no spray nozzles or moving parts, work stoppages for servicing are reduced and additional economies are effected through low h. p. pumping needs. High reclamation averages are reported for all types of pigments. The unit shown is available in all sizes and is equipped for fluorescent lighting. Other types are engineered to meet specific production requirements.

Bulletins, specification sheets and other data are available from Aqua-Restor Division, Mayer Manufacturing Corp., Dept. OF, 56 Division Place, Brooklyn, N. Y.

Air Power Stacker For Use In Explosive Atmospheres

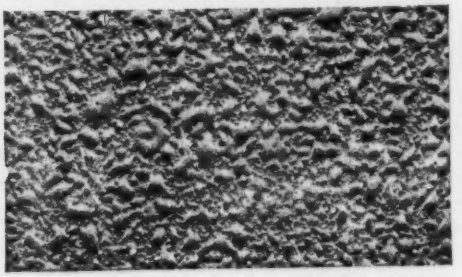
The Lewis-Shepard Sales Corp., Dept. OF, 600 Walnut St., Watertown, Mass., is now featuring their Air Power Stacker, a portable elevator for use in connection with various hazardous operations. In offering this type of stacker with air power motor, Lewis-Shepard state that it is safe, fast and efficient in all explosive atmospheres, including paint and lacquer rooms.

Powered by a rugged air motor, this stacker is claimed to operate efficiently at the same air pressure and volume as industrial overhead air hoists.

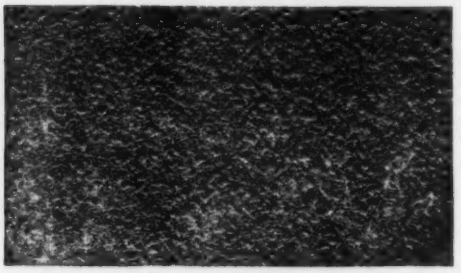
Precise control of the stacker platform is at the operator's finger tips so that any speed of lifting or lowering between the maximum top speed and zero is instantly obtainable. A "dead man" cable control stops the air motor and stacker platform when the operator removes his hand from either one of the dual, holdover controls. This "cable" control runs the full height of the stacker and is standard equipment.

"Chemroc"

A new coating for cast iron and sheet steel, "Chemroc," is manufactured by Ferro Enamel Corp., Dept. OF, Cleveland, O. This coating, which resembles porcelain enamel only in that it is inorganic, is said to be highly resistant to corrosion and heat and to be much superior to rustproofing and galvanizing. It is applied in very thin coats and matures at 700° F. It may be sprayed or dipped and is available in black, olive drab, battleship gray, brown and similar colors.



Above is an unretouched photograph of a panel finished with Pebble-tex as a coarse-textured medium.



This panel illustrates a finer texture possible by using this new finish. Spray gun adjustment and application technique govern the pattern size.

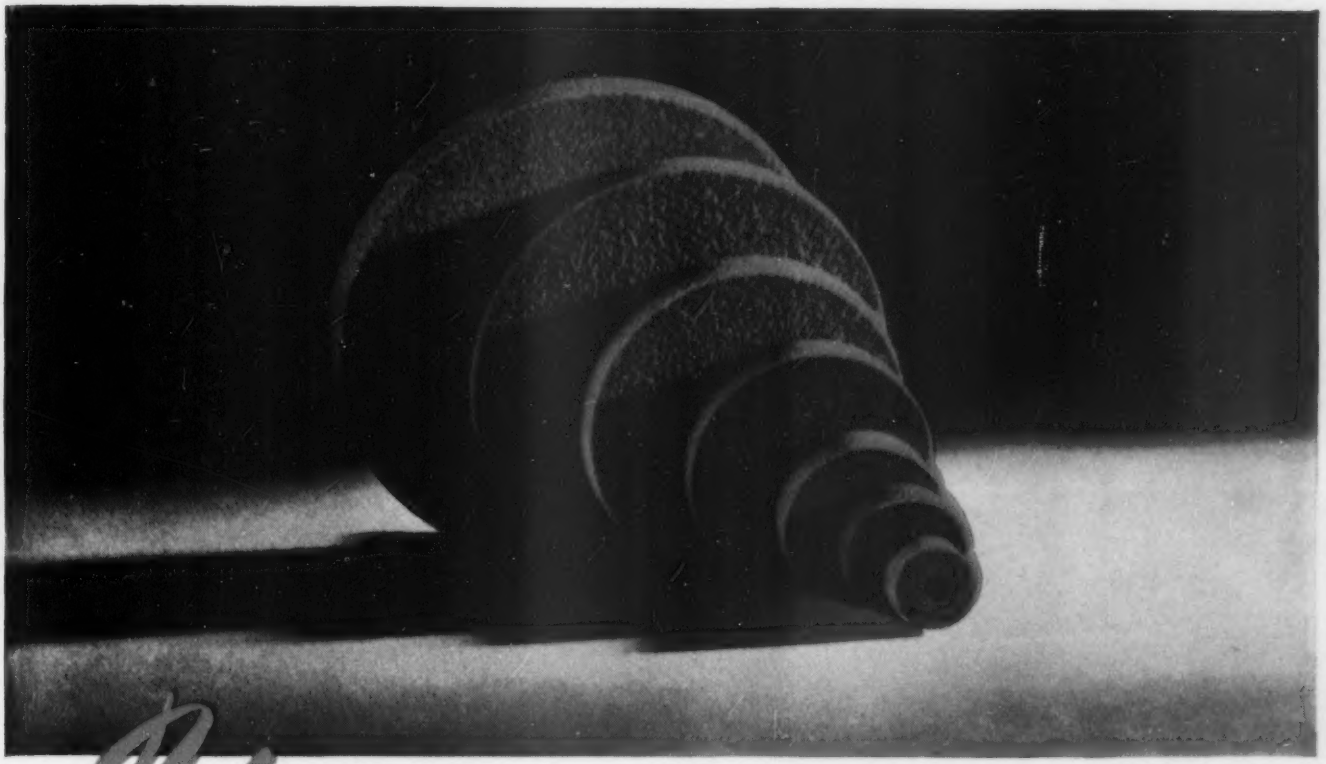
A New Finish

The Egyptian Lacquer Manufacturing Co., Dept. OF, Rockefeller Center, New York, N. Y., manufacturer of special finishes for specific requirements, announce a new war time rough metal finish called Pebble-Tex.

This new finish is recommended to manufacturers of parts for radio equipment for military use, and for instrument panels, fire control and listening devices, and other service items requiring a textured high speed metal finish. For full protection, it is recommended that the finish be applied over a primer, but the pattern may be obtained with a single application on the bare metal.

Here are shown two panels which are finished with this new material. Both the rough and fine texture and varying degrees in between may be obtained from the same mix by gun adjustment and application technique.

Pebble-Tex is available in a variety of colors.



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Fully approved and endorsed by W P B, here's our wartime speed setup:

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- No quitting whistle. We are on the job making wheels 24 hours a day, every day.
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TRY ONE—Tell us the kind of equipment, the job, and size wheel you want to try. We'll send it postpaid.

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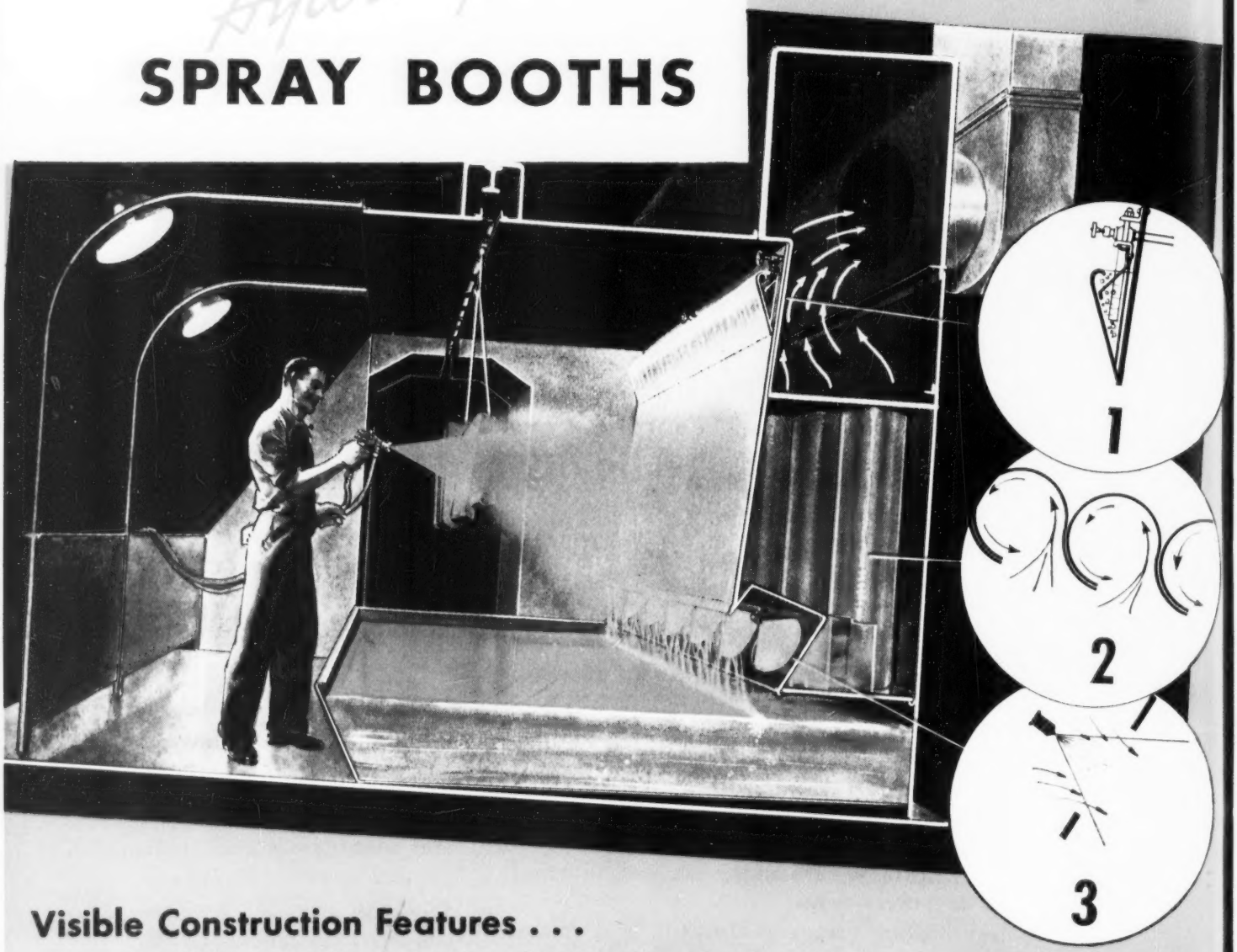
- *Accessibility*



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1 Adjustable reservoir construction of gutter above flood sheet insures an even flow of water over sheet, keeping entire surface clean.

2 Centrifugal eliminators separate all water from air stream. Clean air only is whirled upward to exhaust. Water drops to sludge tank below.

3 Visible high-pressure, cone-shaped water sprays, projected through circular orifices, thoroughly wash pigment from air stream—provide an effective seal against passage of fire.

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No matter how large or how small your plant or product may be, the Mahon Hydro-Filter Spray Booth can be adapted to your particular conditions. Mahon engineers design each installation precisely for each specific purpose. They will cooperate in the laying out of your entire spray painting production system.

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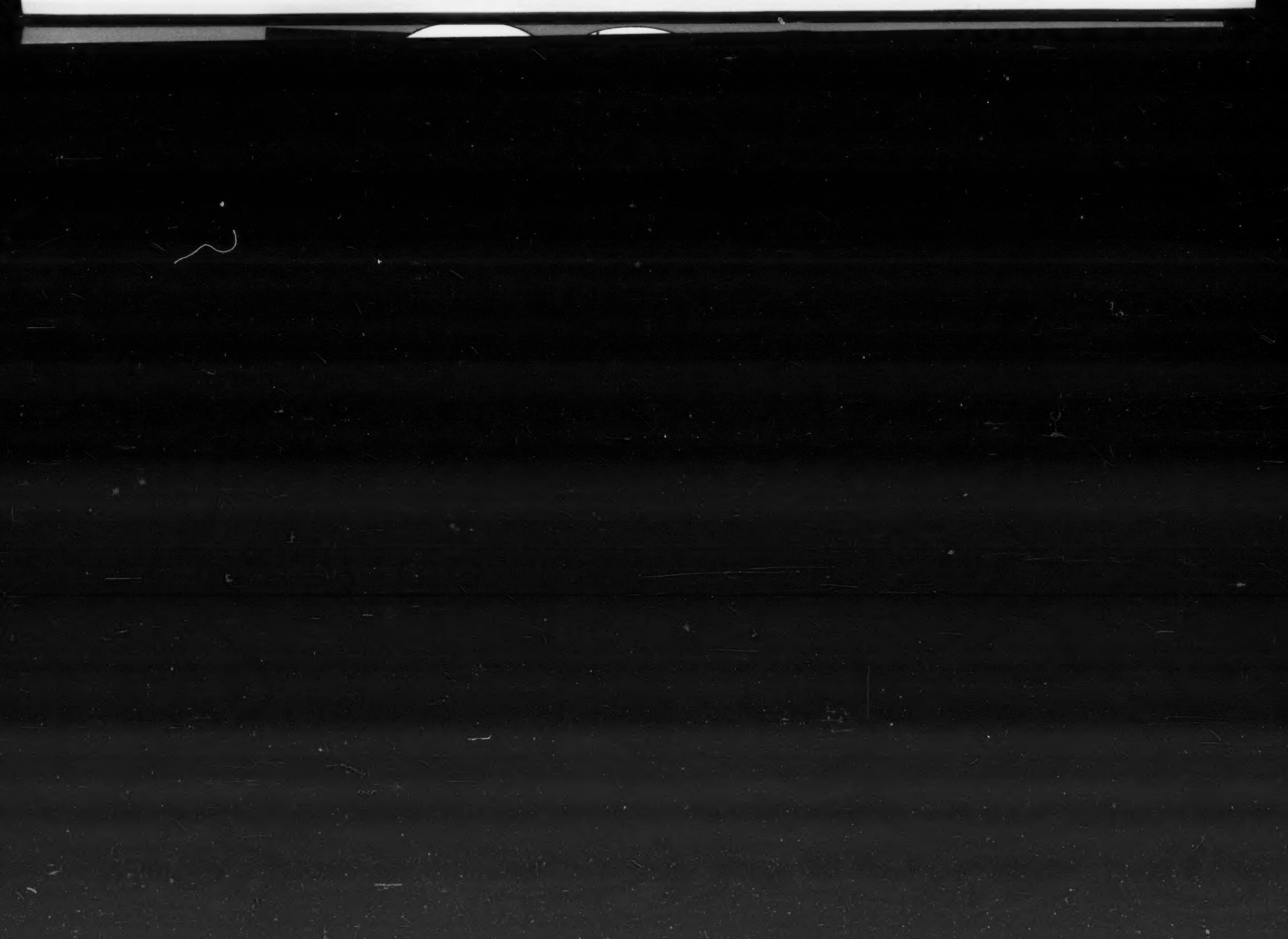

Supply Prices, June 28, 1943

Anodes

Prices are f.o.b. shipping point on quantities of from 500-999 lbs. for copper, brass and zinc. For nickel, prices are for quantities from 500-2,999 lbs.

*Copper: Cast, elliptical, 15" and longer	25⅛c. per lb.
Electrolytic, full size, 22⅞c; cut to size	22⅞c. per lb.
Rolled, oval, straight 15" and longer 23¼c. per lb.; curved	24¼c. per lb.
*Brass: Cast, 80-20, elliptical, 15" and longer	23⅝c. per lb.
*Zinc: Cast, 99.99, 16" and over	16¼c. per lb.
*Nickel: 95-97 cast, elliptical 46c. per lb., 99% plus cast 47c.; rolled, depolarized	49c. per lb.
Silver: Rolled, .999 fine per Troy (100 oz. lots)	49½c. per oz.

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P., dms., l.c.l.	lb.	.09
Acid, Acetic, glacial, 99.5%, bbls.	lb.	.094
*Boric, tech., 99.5% gran., bbls.	lb.	.063
Chromic, 99%, dms., l.c.l.	lb.	.1675-.1825
Hydrochloric (muriatic) 20°, cbys., wks.	lb.	.0175
Hydrochloric (muriatic) C.P., 6 lb. bottles	lb.	.19
Hydrofluoric, 30% rubber dms.	lb.	.08-.09
Hydrofluoric, 48%, rubber dms.	lb.	.12
Nitric, 36°, cbys. 1-9, wks.	lb.	.0595
Nitric, 42°, cbys c.l., wks.	lb.	.065
Oleic (Red Oil), dms.	lb.	1325-.1425
Oxalic, small quantities	lb.	.125
Phosphoric, 75%, c.l., cbys.	lb.	.0510-.0535
Stearic, double pressed, bags	lb.	.1578-.1678
single pressed, bags	lb.	.1538-1638
triple pressed, bags	lb.	.1858-.1958
Sulfuric, 66°, cbys., c.l., wks.	lb.	.015
Alcohol, Amyl (Fusel oil, ref'd), l.c.l.	lb.	.151
Butyl-normal, l.c.l.	lb.	.1225-.1575
Denat., S.D. #1, 190 pf., bbls., c.l., wks.	gal.	.62
Diacetone, tech., dms., l.c.l.	lb.	.115-.14
Methyl, (Methanol), synthetic, dms., l.c.l.	gal.	.37
Propyl-Iso, 99%, dms. l.c.l.	gal.	.47
Propyl-Normal, dms., wks.	gal.	.67-.70
Alum, ammonia, granular, bbls. wks.	lb.	.04
Potash, granular, bbls., wks.	lb.	.0425
Aluminum Sulfate, iron-free, bgs., c.l., wks.	lb.	.02-.0210
Ammonia, aqua, 26°, cbys.,	lb.	.0525
Ammonium, chloride (sal-ammoniac), white granular, bbls., wks.	lb.	.0515
Ammonium, Sulfate, dms. bulk	ton	$29.20
Sulphocyanide (thiocyanate) tech., bbls.	lb.	.17
Antimony Chloride (butter of antimony), sol., cbys..	lb.	.17
Arsenic, White, powd., keg, l.c.l.	lb.	.0475
Barium Carbonate, pptd., bags, l.c.l., wks.	lb.	.03
Benzene (Benzol), 90%, dms., wks.	gal.	.20
Borax, tech., bgs.	ton	$61.00
*Butyl Lactate, dms.	lb.	.205
*Cadmium Oxide, l.c.l., bbls.	lb.	.95
Calcium Carbonate (Pptd. chalk), c.l., wks.	lb.	.02
Calcium Chloride, flake, paper bgs, 5-ton lots	ton	$28.50-$41.00
Carbon Tetrachloride, l.c.l., 52½ gal. dms.	gal.	.80
Cobalt Sulphate, dms.	lb.	.65
Copper, Acetate (verdigris), bbls.	lb.	.26-.50
Carbonate, 52-54%, bbls.	lb.	.195-.205
Cyanide, tech., 100 lb. bbls.	lb.	.34-.38
Sulfate, 99%, crystals, bbls., c.l., wks.	lb.	.0565
Cream of Tartar (potassium bitartrate), kegs	lb.	.585
Crocus Martis (iron oxide), bbls., c.l.	lb.	.09
Dextrin, white, bags, l.c.l., F.O.B. Chicago	lb.	.0415
Diethylene Glycol, dms., l.c.l., wks.	lb.	.155
*Emery (Turkish)	lb.	.08
Ethyl Acetate, 85-90%, l.c.l., dms.	lb.	.122-.125
Ethylene Glycol, l.c.l., dms.	lb.	.11
Monobutyl ether, dms., l.c.l., wks.	lb.	.175-.205
Gold, Chloride, yellow, 4 oz. bottles	oz.	$18.75-$19.00
Cyanide, potassium 41%, bottles, wks.	oz.	$14.20-$14.95
Cyanide, sodium (46%)	oz.	$17.10
Gum, Arabic, white, bgs.	lb.	.33-.35
Hydrogen Peroxide, 100 vol., cbys.	lb.	.16-.185
Iron Chloride (ferrous), cryst., l.c.l., f.o.b., Midland, Mich.	lb.	.035
Iron Chloride (ferric), cryst., bbls.	lb.	.05-.08
Iron Sulfate (Copperas), cryst., bbls., 1-4 wks.	lb.	.02
Lead, Acetate (Sugar of Lead), cryst., bbls.	lb.	.125
Oxide (Litharge), com., powdered, bbls.	lb.	.09
Lead, White, dry, bbls.	lb.	.085
Magnesium Sulfate (Epsom Salts), tech., bbls.	lb.	.019
Mercury Bichloride (Corrosive Sublimate), cryst.	lb.	$2.39
Mercury Oxide, tech., bbls.	lb.	$3.11
Mineral Spirits, tanks	gal.	.10
Naphtha. V. M. & P., tanks	gal.	.11
Nickel, Carbonate, dry, bbls.	lb.	.36-.365
Chloride, bbls.	lb.	.18-.20
Salts, bbls.	lb.	.13-.135
Paraffin, refined, 123-125 A.M.P.	lb.	.052
Perchlorethylene, dms., l.c.l.	lb.	.0832-.085
Potash, Caustic, 88-92%, flake, wks., c.l.	lb.	.07
Potassium, Bichromate, casks	lb.	.0975-.10
*Carbonate (potash) calc., wks., dms.	lb.	.065
Cyanide, dms., wks.	lb.	.55
Nitrate, rfd., gran., bbls.	lb.	.0835-.086
Permanganate, tech., dms., wks.	lb.	.1975-.2025
Phosphate, dibasic, ¼ lb. bottles	lb.	.91
Pumice, ground, 1½ F. & coarser, bbls., wks.	lb.	.0378-.045
Quicksilver (Mercury), f.o.b. West Coast, 76 lb. flasks, net	flask	$191.00
Rochelle Salt, crystals, bbls.	lb.	.44-.47
Rosin, gum, D dms., dock	lb.	.0366
*Silver, Chloride, dry, 50 oz. lots	oz.	.455
Cyanide, 100 oz. lots	oz.	.415
Nitrate, 100 oz. lots	oz.	.32⅜
Sodium, acetate, flake, gran., powd., 60%, bbls. l.c.l.	lb.	.055-.06
Bisulphite, powd., bbls., l.c.l., wks.	lb.	.035-.036
Bicarbonate, tech., bbls., l.c.l.	lb.	.0205
Bichromate, l.c.l., wks.	lb.	.075-.0775
Carb. (soda ash), light, 58%, bags, l.c.l.	lb.	.0213
Citrate, U.S.P., dms.	lb.	.24-.29
Cyanide, 96%, dom. 100 lb. dms.	lb.	.145-.15
Hydroxide (caustic soda) 76%, flake, l.c.l.	lb.	.0355
Metasilicate, granular, 1-9 bbls.	lb.	.033-.0355
Nitrate, rfd., gran., bbls., wks.	lb.	.0375-.04
Nitrite, 96-98%, dom., bbls., l.c.l.	lb.	.089-.119
Orthosilicate, anhyd., l.c.l.	lb.	.0545-.0585
Phosphate, dibasic, cryst., bags, l.c.l., wks.	lb.	.0295-.0345
Phosphate, tribasic, kegs, l.c.l., wks.	lb.	.0415
Pyrophosphate, anhyd., bags, c.l., wks.	lb.	.0528-.0610
Sesquisilicate, dms., l.c.l.	lb.	.0405-.043
Stannate, dms.	lb.	.325-.365
Sulfate, anhyd., bbls., wks.	lb.	.022-.024
Sulfide, cryst., bbls., l.c.l.	lb.	.029-.0315
Sulfocyanide, C.P., dms.	lb.	.55-.65
Thiosulfate, cryst., bgs., wks., l.c.l.	lb.	.025
Sulfur, Flowers, U.S.P., l.c.l.	lb.	.034-.0355
Toluene (Toluol), 2°, ind., dms.	gal.	.33
Trichlorethylene, dms., l.c.l.	lb.	.085
Tripoli, air-floated, bgs., c.l., wks.	ton	$21.50
Wax, Bees, yellow, crude	lb.	.4475
Carnauba, refined, bags	lb.	.7775-.90
Spermaceti, blocks	lb.	.26-.27
Whiting, chalk, l.c.l.	ton	$20-$24
Xylene (Xylol), ind., returnable dms., wks.	gal.	.32
Zinc, carbonate, tech., bbls.	lb.	.14-.20
Cyanide, kegs, wks.	lb.	.33-.37
Chloride, tech., granular, dms., c.l., wks.	lb.	.0575
Dust, bbls.. l.c.l., wks.	lb.	.1135
Oxide, lead-free, bags, l.c.l.	lb.	.075
Sulphate, crystals, bags, l.c.l.	lb.	.0435

* *As of May*, 1943.

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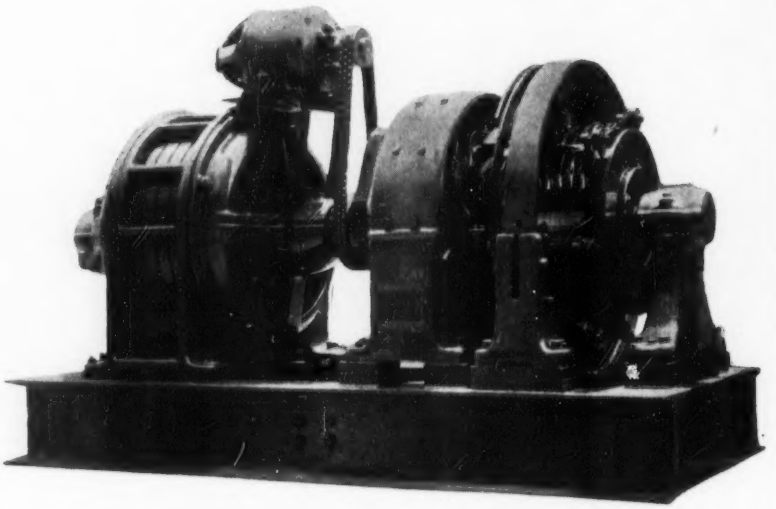

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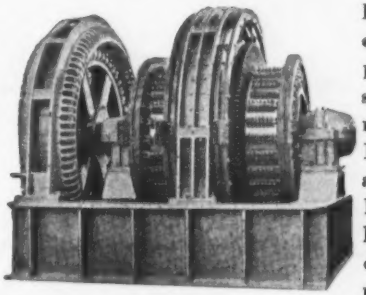

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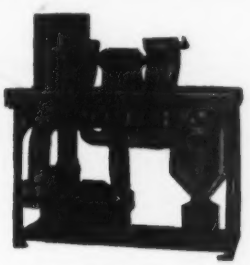
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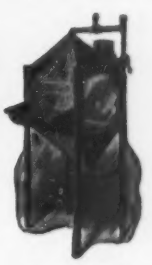
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ODDS and ENDS

Convention Report: The Buffalo Branch deserves a great deal of credit for putting over the record-breaking 31st annual convention of the A. E. S. in bang-up style. We wonder if *Dr. Wernlund*, the general chairman, has caught up on his sleep yet. He certainly covered a lot of territory during the convention keeping everything moving like clockwork.

Joe Ruff provided the highlight of the first educational session when he introduced Dr. Anderson's paper on the Cronak process for treating zinc as the *Cronic* process. A special award should have been given *Van der Horst*, whose completely unaffected humor overshadowed the technical aspects of his talk on porous chromium and had the cash customers rolling in the aisles. Discussing a photomicrograph of a cross-section of the oil-retaining porous chromium deposit, he said, "*These are what we call oil grooves. They're really cracks, but cracks don't sound so good so we call them oil grooves.*" The audience watched with rapt attention as he stopped in the middle of his talk, removed a small pair of scissors from his pocket, snipped off the end of a cigar, returned the scissors to his pocket, carefully lit the cigar and nonchalantly continued from where he had left off. The applause accorded him on the conclusion of his talk was the greatest we've ever heard at a technical meeting and he deserved every bit of it.

Both *F. P. Green* and *F. W. Rock* called the removal of burrs *deburring* while *Dr. H. L. Kellner* insisted it should be called *burring*. O. K., Doc.,—let's you and them fight. Personally, we wonder how easy it would be to sell degreasing machines if the manufacturers called them *greasing* machines. Incidentally, did *Logozzo* say *mass* of parts or *mess* of parts? Or were both correct??

Suggestion Dep't: For the better enjoyment of future conventions, why not schedule for *evening* presentation all talks which employ lantern slides so that no difficulty will be encountered in darkening the meeting room?

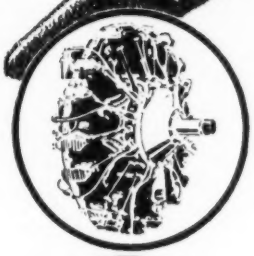
A good subject for argument seems to be whether or not it is necessary to heat treat tools and dies after hard chromium plating. *Austin Fletcher* is numbered among the pros and *D. A. Cotton* among the cons. Perhaps some day this question will be settled once and for all.

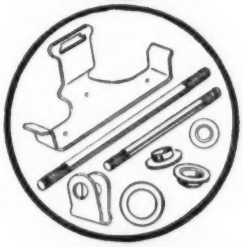
Things We Never Knew 'Til Now: The gas tank on a Flying Fortress requires 500 lb. of rubber for bullet sealing. This should be remembered when the W. P. B. turns down a request for a rubber covered plating rack. We wonder how many of our readers, like we, have been using the symbol *lb.* for pound almost daily for years without ever stopping to ask what it meant? Well, it is derived from the word *libra*, the Roman pound, in case anyone else is interested.

The salt spray test was originated almost 30 years ago (in 1914, to be exact) by J. A. Capp, for determining relative resistance in *sea coast* atmosphere. Would he have done it, had he known what he was starting??

Slogan of the Month: Freedom Insurance is as Important as Life Insurance.—Buy War Bonds.

ATTACK!





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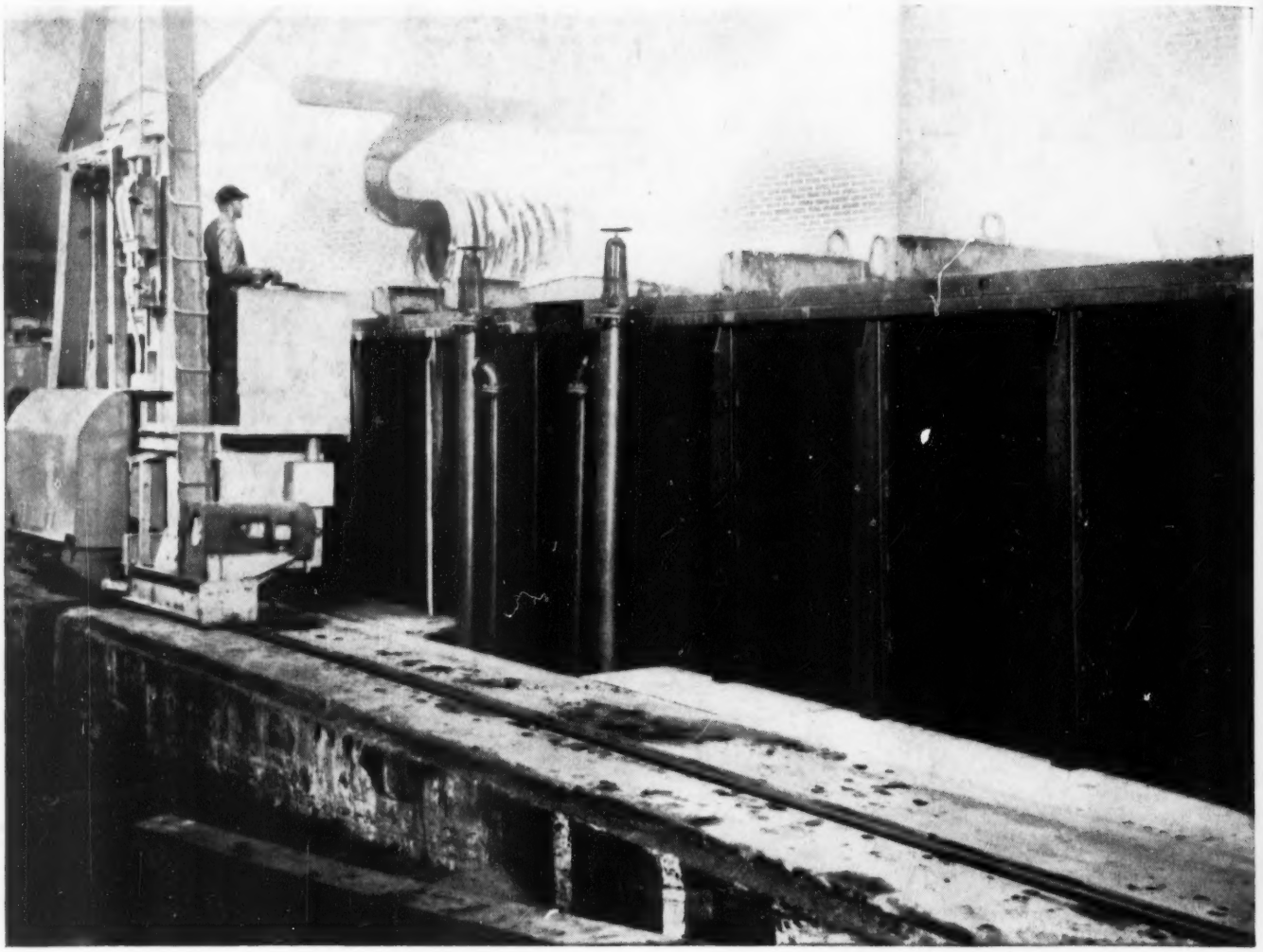

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PAINT seldom faces a tougher job than when used on the exterior of hot, non-ventilated pickling tanks. In addition to the viciousness of the fumes arising from hot sulphuric acid, there is the frequent spillage that occurs, plus the moisture which aggravates any corrosive condition.

In this toughest kind of service, where the life of most industrial paints is measured in terms of but a few months (sometimes but a few weeks) Tygon Paint is still taking it, the original gloss not even dulled after more than fifteen months!

The reason? Tygon Paint is, essentially, pure Tygon (the chemically inert, rubber-like plastic used to line tanks in which corrosives are made and handled) liquefied by the addition of appropriate solvents. These solvents, on evaporation, leave a sturdy, durable film of chemically unchanged Tygon.

Tygon Paint films are odorless when dry, tasteless, and relatively non-toxic (they may be formulated to be totally non-toxic, if desired). The films are tough, flexible, and non-inflammable. Tygon Paints show no tendency to crack, craze, check or "weather" even after long exposure to air, sunlight, moisture or other oxidizing elements. They are highly resistant to acids, alkalies, alcohols, greases, oils and fats. Certain formulations will even withstand hot aromatic fuels.

For detailed information on the use of Tygon Paints, and other Tygon corrosion-resistant materials: linings, rigid or flexible tubing, gasketing materials, impregnating solutions, or molded Tygon products, write: U. S. Stoneware Company, Akron, Ohio. In Canada: Chamberlain Engineering, Ltd., Montreal, Que.

U. S. STONEWARE
AKRON, OHIO